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A Glance at the Contents—

Progress of Applied Chemistry.

A notice is published of Vol. XV., 1930, Annual Reports of the Society of Chemical Industry on the Progress of Applied Chemistry. [p. 281.]

Glover-West Verticals at Grangemouth.

We give an account of the official opening of the new Glover-West vertical retort installation at the Grangemouth Gas-Works. The plant was described in the "JOURNAL" for Jan. 7, 1931. [p. 279.]

Model Staff Restaurant Kitchen.

We publish an illustrated description of the staff restaurant and kitchen equipment at Harrods' Stores, in which gas figures largely. The installation caters for the thousands of members of the staff. [p. 282.]

The Society of Chemical Industry's Jubilee.

Leading scientists from all over the world are to attend the Jubilee Celebrations of the Society of Chemical Industry, which will take place in London during the week commencing July 13, under the patronage of His Majesty the King. The proceedings will be under the Presidency of Sir Harry McGowan, President of the Society, and will comprise a wide programme of scientific discussions, social functions, and visits to industrial centres. [p. 270.]

Ash in Coke.

In a paper before the Institute of Fuel, Mr. Arnold Marsh, M.Sc., said that the ash in coke is more flocculent and bulky than that derived from coal, and, apart from the ease with which it will fly about the room (a further point requiring examination) appears to be greater in quantity than it actually is. Thus to a housewife, a coke containing (say) 10 p.ct. of ash will appear to be "dirtier" than a coal containing a like amount. There is no doubt that many people using such fuels for the first time have been permanently prejudiced against them because of what they have considered to be an excessive quantity of ash. [p. 284.]

Importance of the Gasfitter.

Recently the Yorkshire Junior Gas Association were entertained by the Halifax Gas Department, and inspected the Halifax Gas-Works. At a business meeting on the same occasion Mr. A. Wylie, Sales and Fittings Superintendent to the Sheffield Gas Company, read a paper dealing with the organization of a fittings department. The practical side of gasfitting, he said, requires skilful treatment in execution, and the good judgment of the operative has often to be exercised to an even greater degree than in some trades at present enjoying pride of place. "The importance of the work entrusted to a gasfitter cannot be over-estimated. Provided he is supplied with the proper tools and has enthusiasm for the work entrusted to him, he can be just as effective in giving satisfaction and emphasizing the meaning of 'service' as any other branch of our Industry." [p. 288.]

Gas Salesmen's Day.

A presentation to Sir Francis Goodenough, C.B.E., was an interesting feature of the proceedings at the Eighth Annual Meeting of the B.C.G.A. Gas Salesmen's Circles in London, which was attended by representatives of over a hundred gas undertakings. [p. 273.]

The B.E.S.A. Street Lighting Specification

"Gas Engineers," says Dr. J. W. T. Walsh in an article on this subject, "must be prepared to take a very large share in the general movement towards better street lighting, and to help the public lighting engineer in his task of extracting the last ounce of efficiency—as rightly understood—from his installations." [p. 275.]

Working of Glover-West Verticals.

At a meeting of the Midland Junior Gas Association, Mr. H. G. Broadbridge, of Leamington Spa, told the members of some of the minor difficulties encountered in the working of a vertical retort installation, and the means adopted for overcoming them. The troubles included coke dust, and noise from the waste-heat boiler plant. [p. 286.]

Gas Lighting.

In a paper on this subject Mr. J. G. Clark, of the Gas Light and Coke Company, states that the radiant efficiency of an inverted incandescent burner measured thermally is about 30 p.ct., which means that it can contribute substantially to the comfort of the person using the light. "In addition to this, the warm products of combustion distribute themselves over the ceiling, creating thereby what is virtually a large warm panel which radiates downwards. It might be urged by our competitors that this warming effect may sometimes be a drawback, which is in some measure true, as it is true of most useful things; but I think an examination of temperatures in this country over a whole year would show that 99 times out of 100 the warmth would be a distinct advantage, and the absence of it would call for some supplementary source of heat to maintain comfortable conditions." [p. 291.]

Gas Distribution in America.

A correspondent outlines the proceedings at the eighth annual distribution conference of the American Gas Association. The advent of natural gas into city areas, he remarks, is resulting in increased distribution pressures. In Los Angeles, 150 lbs. is carried in the high-pressure lines, and 7 in. in the low-pressure network. Other cities are slowly changing from 3 and 4 in. to 5 and 6. This tendency to greater pressures has given impetus to the pipe joint research now in progress at the A.G.A. laboratory, and one session was devoted to this and related pipe subjects. Another session was occupied with a second factor in the tightness of a distribution system—viz., the corrosion of steel pipe and the effect of protective coatings. The soil corrosion studies and the pipe coating research as conducted by the Bureau of Standards were well presented, [p. 283.]

EDITORIAL NOTES

B.C.G.A. Executive Chairman

THE intimation which will be found in our "Personal" column to-day of the pending early retirement of Sir Francis Goodenough from the position of Controller of Gas Sales to the Gas Light and Coke Company, which he has occupied for the space of a generation, will come as somewhat of a shock to readers of the "JOURNAL," many of whom never knew the industry without Sir Francis in that post. But, in view of the development of his public work in recent years, and the probability—one may say, in fact, his health and circumstances permitting, the certainty—of its increase in the future (to the great advantage of the Industry with which his name is so closely associated), the news ought not to cause great surprise. Indeed, on full consideration of the facts, we are confident that any shock or surprise first occasioned will rapidly give place to a feeling of great satisfaction, in that the release of Sir Francis from departmental duties for his Company is, we are assured, to be attended by his continued and increased activity as Executive Chairman of the British Commercial Gas Association.

That this should be assured is, we do not hesitate to say, of the utmost importance to the Gas Industry at the present juncture in its history; for never was there a time when the business development side of the Industry called for more energetic direction and drive by the best men the Industry can find. That Sir Francis Goodenough should be now in a position to devote his knowledge, experience, and abilities to leadership in that work, both for the Association to which he has been loaned by his Company for twenty years and for individual undertakings which may secure his counsel and advice, is in our opinion an event on which the Industry is to be congratulated even more than Sir Francis—though all his many friends will join with us in offering him cordial congratulations on this development in his career, and in wishing him many years of health and happiness in the continued service of the Industry to which he has already devoted some forty-three years of his life.

The Governor and Directors of the Gas Light and Coke Company have put the Industry in past years under many debts of gratitude. None has been heavier on the commercial side than that due for making it possible for Sir Francis to do so much to develop first the B.C.G.A. itself, next the Salesmen's Circles, and latest, but we hope not last, the Commercial Education Scheme just launched with so much promise of benefit to all. To our mind they have now added the greatest of all—namely, that of rendering it possible for the Industry to get a still greater measure of his time, thought, and energy, his creative faculty, and his gift of making friends in many spheres of public life.

Gas Lighting

THE Technical Press receives more cuffs than kisses; hence we appreciate the compliments of Mr. J. G. Clark, of the Gas Light and Coke Company, concerning our attitude to the question of gas lighting. To what extent we have helped in the revival of interest in gas lighting in this country is not for us to say; but we have helped, and there really is a revival. During the past two years, in particular, our columns have provided a battery of ammunition, of both a technical and a general nature, calculated to improve, retain, and extend illumination by gas indoors and out of doors; and the numerous examples of "gas victories" which have been noted in the "JOURNAL" must have served as a source of encouragement and enthusiasm. In to-day's issue, for instance, reference is made to two notable cases where gas has demonstrated its merits as a street lighting agent after comparative trials with electricity. These two cases are Hampton Court and Bradford.

Also in our issue to-day are published two exceedingly important contributions on gas lighting by acknowledged experts on the subject—Mr. Clark, who has devoted a lifetime's work to the study of illumination by gas, and Dr. J. W. T. Walsh, of the National Physical Laboratory, who is one of the foremost exponents of the science of lighting not only in this country but in the world. These two articles should certainly be studied by our readers. Mr. Clark deals with both domestic and street lighting, while Dr. Walsh concerns himself solely with the interpretation of the B.E.S.A. Street Lighting Specification, and urges that gas engineers have a very big responsibility and a correspondingly big opportunity in the field of public lighting. He suggests that the fact that the International Congress on Illumination is being held in England next September should act as a stimulus towards the improvement of the street lighting systems, which are so largely the concern of the gas undertakings of this country. Mr. Clark also points out that this year offers a suitable occasion for making a general review of gas lighting, for the International Commission is the direct outcome of the activities of the Gas Industry at the commencement of this century. It is a regrettable fact that during the last thirty years gas has figured less and less in the programmes of the Commission—and this without any justification. Apart from international programmes, to what extent has gas lighting figured in the Transactions of either the Senior or the Junior Associations of our Industry during the past ten years? We look for improvement, and believe that it will come, for gas lighting is a "key" to further development of gas utilization.

And now, for a moment, let us refer to one or two of the salient features of the valuable contributions by Mr. Clark and Dr. Walsh. The former, having observed that, though gas lighting is being challenged by our competitors, gas is still the major means of providing artificial lighting in this country, goes on to consider why gas is intrinsically a good lighting medium, and some of the steps which should be taken to render it a still better medium. Regarding the first phase, it has been shown, notably by Sir Leonard Hill, that the light emitted from an incandescent gas mantle is singularly suited to the human organism. Then the warmth which accompanies illumination by gas is valuable. The radiant efficiency of an inverted incandescent burner is about 30 p.ct., and the warm products of combustion distribute themselves over the ceiling and create a large warm panel which radiates downwards. Again, its powers of diffusion are definitely to the advantage of gas. To exploit these advantages, Mr. Clark emphasizes the need for pushing switch-controlled lighting as distinct from mere gas lighting, as Mr. H. E. Bloor is doing at York; for accurate design of burners; and for the use of mantles produced to specification in regard to diameter and length. He points out, too, that governing in relation to gas lighting is worthy of careful consideration, and he offers several suggestions to manufacturers of gas lighting equipment. "Gas regulators will no doubt soon be things of the past" is, for example, a significant statement. Again, his remarks on ceiling discoloration are of great interest. This is what he has to say on the matter: "The impact of the convection currents is evidenced by the darkening of the ceiling. This

point is worthy of investigation. It is well known that the dark stain is due to dust suspended in the air. If, therefore, the amount of air passing through the burner is reduced to a minimum the darkening effect upon the ceiling might be lessened. One can imagine a lighting burner designed to emit its hot products of combustion at the bottom of the globe or shade somewhat like a bottom flue outlet cooker. I am making this suggestion in the hope that inventors will get busy."

The B.E.S.A. Specification

TURNING to street lighting, Mr. Clark devotes most attention to the B.E.S.A. Specification, observing that the stress laid on the importance of minimum illumination has tended to encourage the use of high-power units arranged so that the rays that reach the test point are not very far removed from a horizontal line drawn through the centre of the light source. "It is true," he says, "that the 'test point' illumination value may be raised substantially in this way, but it is a great question whether the added glare does not more than neutralize this advantage. It is, I think, an opportune moment now to look at this matter fairly and squarely, in order to make sure that present-day development is on the right lines. Personally, I have great doubts, although, as is well known, it is being done in connection with gas lighting." In further criticism of the B.E.S.A. Specification, Mr. Clark thinks that the allowable deterioration from the declared contract value is far too great, and that the illumination at the test points as defined by the Specification can be substantially higher than the minimum illumination discoverable by a survey of the working area of the road. "The Specification has encouraged the use of devices giving powerful, but quite narrow, beams of light. This seems to be poor 'street lighting,' but as it is permissible under the B.E.S.A. Specification great doubt must be thrown on the value of the recommendations as they stand now."

In view of the foregoing, it is singularly interesting to read what Dr. Walsh has to say about the matter. He emphasizes that the old aim of a uniform illumination of the road surface was quite misdirected, and that a reasonable diversity ratio is certainly permissible, though a great diversity is definitely bad. To obviate too great a diversity, the B.E.S.A. Specification directed that the value of illumination measured is that at a point where it may reasonably be expected to be a minimum; in fact, it is laid down that "the illumination at any part of the ground . . . shall not be substantially less than the illumination prescribed for the test-points in the foregoing clauses." In other words, the illumination considered in the Specification is the *minimum* illumination, or something very near it.

The essence of Dr. Walsh's admirable article is that the diversity ratio of a lighting system must be kept within reasonable limits, and that an increase in the mounting height of lamps is desirable in order to increase the illumination at the mid-point and to reduce the diversity ratio of the system. "It is often thought," he remarks, "that an increase in mounting height must necessarily involve a marked decrease in the illumination on the road surface unless the candle-power of the light source is proportionately increased. The facts are, however, quite otherwise. Actually it is quite easy to show that a considerable increase in mounting height may well result in a noticeable increase in the illumination of the central part of the span. The illumination of the area close to the post is, of course, reduced, so that the result of raising the lamp is to reduce the diversity and increase the illumination where it is most needed."

As Dr. Walsh remarks, the relative advantages of the average and the minimum illumination as a criterion in street lighting have been discussed at great length and for several years, and there is even now no general agreement on the matter, either in this country or internationally. Put briefly, the argument for the adoption of the average is that it is much less likely to be misleading, for the minimum may refer to either a large or a small part of the total area and bears no definite relation to the general level of the illumination over the whole street. The average, on the other hand, does indicate the general level, but it has the great drawback that it is much more difficult to measure, and it does not indicate one very important matter—viz., the illumination at the darkest point. We have no doubt that, studied conjointly, the contributions of Mr. Clark and Dr. Walsh will prove of the greatest benefit.

Gas Preferred

AT the end of a full day's debate on the Isle of Man Electric Light and Power Bill, the House of Keys threw out the measure, which was based on a report prepared by a Commission appointed by the Governor, and would have given powers to the Electric Development and Securities Trust, Ltd., to supply, under proper safeguards, the area not supplied by the Douglas Corporation. The Bill passed the Council last year, but when it came to be considered by the Keys they appointed a Committee who visited various undertakings in England, and presented a report recommending the setting up of an insular Board to supply the Island with light and power. After the moving of a formal resolution in favour of the recommendations contained in this report, the Advocate for the Company promoting the Bill addressed the House, urging, probably with excellent reason, that the Company (which he said was allied with the General Electric Company) would be quite as efficient and up-to-date, and would give as good a service to the community as would a Government-run scheme. The requisite outlay was put at from £70,000 to £120,000, and it was stated that the idea was to form a local Company, so as to give the public an opportunity of taking up shares.

The debate was an interesting one, brightened by some flashes of humour, and at least one example of slightly involved metaphor—when one member declared that the Company promoting the measure "was just a tentacle of the great electrical octopus of the world, and the Bill was a feeler to get hold of the Isle of Man and get it under the claw for all time." It is, however, a purely domestic matter for the Island to decide, and it would have interested us little, but for the comment upon the proceedings made by the "Isle of Man Weekly Times." This should be noted by those people—a far too numerous body—who are ever anxious to write electricity with a very big capital "E," and gas with a very small "g." The view of the writer of that article is that the decision of the House of Keys has deprived the inhabitants of the lesser towns of the Island, and of the rural districts, of any general supply of electric light "for a considerable time to come." That may or may not be an advantage to the community, according to the point of view. The writer of the article himself puts electric light no higher than a "desirable amenity of life —not a necessity to anybody."

Then he goes on: "The towns of the Island have gas in the streets and gas in the houses, and the replacement of gas by electricity is not in the least a matter of urgency. In Douglas, after a public electricity supply has been on offer for nine or ten years, the majority of householders have not availed themselves of it, even for lighting; and for heating and cooking, the public definitely prefers gas. . . . There is no evidence whatever that existing industries in the Island are suffering for lack of the motive power supplied by electricity, or that new industries could be created if electric power were available. That the farming industry desires it, or could be induced within twenty years to take it in any appreciable quantity, we regard as mere romance. The existence of electricity supplies would, we believe, encourage the building of houses in the country areas suitable for the residences of immigrants of comfortable means, and this would be a genuine method of developing the Island. . . . The pathetic faith shown by members of the House of Keys in the immediate possibilities of rural electrification is one of the factors which makes us distrust a publicly-elected Board of Management like poison."

Sound common-sense of this kind is a useful corrective to some of the nonsense one nowadays comes across in connection with electricity boosts.

Education v. Smoke

For years now enthusiasts for clean skies and a healthy atmosphere have been hard at work pointing out the wastage of money and life caused by smoke. At first their plea was tolerated, but little action resulted; to-day the plea is less isolated, and it is being listened to with more genuine attention. General education, and such concentrated efforts as those put forward by the National Smoke Abatement Society, will undoubtedly, in course of time, result in a widespread awakening of the public conscience on this matter; and though, in view of the comparatively small progress which has so far been made to eliminate domestic smoke, many may regard the problem as one almost incapable of solution in any reasonably short period of years, we do not share their opinion. When the movement was started, the difficulty was to find a really satisfactory, complete substitute for raw coal. On every ground other than that of cost, gas was, of course, eminently suitable, but the same thing could not be said about the solid smokeless fuels available. There was no adequate marketing organization for coke for domestic use, and, speaking generally, little care was exercised in its manufacture and grading for this purpose. But of late years great changes have taken place. Gas undertakings, if they want the business, are now in a position to market a reliable smokeless solid fuel; and, thanks to remarkable developments in the application of gas in the home, the cost ratio between gas and coal has undergone a transformation. In brief, our Industry has, in gas and coke, a complete and economical substitute for raw coal. And, what is more important, the public are becoming aware of this fact. The national publicity work of the B.C.G.A., together with local propaganda by individual gas undertakings, is gradually having its effect.

The Board of Trade Returns, and the experiences of gas undertakings in the domestic sales of coke, indicate the trend of public opinion in regard to smokeless heating; and regarded by themselves they are very encouraging. But the fact remains that the amount of coal consumed for domestic heating in this country—not *per capita*—remains more or less stationary; and it is an enormous consumption. Therefore, to bring about what would be an undoubted national gain—diminution in the burning of raw coal in the domestic hearth—wider education than that possible by any one industry is necessary. For this reason encouragement and guidance should be given to such organizations as the National Smoke Abatement Society. The man in the street finds it difficult to believe that a public-spirited policy can have place in the progress of vested interests, though in the case of the Gas Industry at least the welfare of the community goes hand in hand with the prosperity of the Industry. This attitude of the ordinary citizen will change, but the change will not be effected quickly until the youth of the country have it really impressed on them that the raw coal habit is an evil habit; and this impression is hardly likely to be made until the teachers of youth believe it.

We arrive at the conclusion, then, that attention should be directed to the Englishman's psychology (sentimentality is perhaps a better word) in regard to the flickering flames of the coal fire in the open grate. "Many thousands of dark and cold winters have been rendered tolerable to our ancestors only because of the indescribable joy of fire, with its glowing embers and leaping flames; and it is only natural that we, in spite of our more sheltered conditions, should have inherited, from such sharp and pleasurable experiences, a similar complete and ineffaceable delight in, and prejudice towards, the open fire." This quotation is from a paper by Mr. Arnold Marsh, Secretary of the National Smoke Abatement Society, before the Institute of Fuel, an extract from which we publish in this issue of the "Journal." The idea of this statement would have been all right had it not been for the unqualified reference to "leaping flames." The open fire itself is not a bad proposition, and we do not object to "glowing embers;" but this "leaping-flame" business has been overdone. A fire is a means of giving warmth and comfort; this is obvious enough. But it is seldom recollected that in former times the flames of the open fire were extremely useful as an illuminant as distinct from a heating agent. Modern lighting arrangements, and conditions of life to-day, seriously interfere with the sport of fire goblins or flame fairies. Let us regard the open fire as a heating medium.

And Coal v. Coke

After we have rid ourselves of sentimentality, the problem is reduced to the simple question, Is raw coal more economical and more comfortable in use than its smokeless substitutes? If it is, then raw coal will continue to be burnt. In this connection there is no doubt that the ash content of carbonized fuels plays a most important part—for two reasons: The ash in a coke is more flocculent than that of the coal, and appears to be greater in quantity than it actually is; and, coke being less dense than coal, the ash content has a marked bearing on the capacity of the grate. Mr. Marsh maintains that many people using cokes for the first time have been permanently prejudiced against them because of what they have considered to be an excessive quantity of ash. "The remedy is to supply fuels which actually have an ash content as far below that of the average household coal as is practicable." This, of course, is no small demand; but every endeavour should be made to meet it. Whatever the success of cokes sales to-day, it is nothing to what could be achieved if the ash content was reduced.

Only recently a man of scientific standing said: "If we can sell our coke—and we are selling it—and the consumer does not complain, why go to all the trouble of carbonizing clean coal, and then find that the expense of this cleaning is not warranted. At present our sale of coke is a business proposition; it might not be if we had to spend a lot of money on the cleaning of coal." Now we cannot tell to what extent, if any, the cleaning of coal would be a burden on coke sales; but we think that the cost of cleaning coal would be justified by the results. And we certainly hold the belief that "what is good enough to-day will be good enough to-morrow" is essentially a wrong idea. The public would, we suggest, respond to a coke containing even twice as much ash as the coke made by Mr. H. C. Smith in his experiments at Tottenham, which he described in the "Journal" for March 25 last. It is on such lines as these that we can hope to do away with the burning of raw coal in the home.

Mr. Marsh, while remarking that all grades of coke have greatly improved, and that coke produced by many gas undertakings (especially that from vertical retorts) is "consistently excellent for household purposes, being clean, dry, low in ash, and high in calorific value and radiant efficiency," is of opinion that the Gas Industry as a whole regards coke as of little importance. Whatever relation this may have to conditions prior to the war, it is surely not true of the present. The results of both laboratory and large-scale work, assiduously carried out for some years, on the production and preparation of high-temperature cokes are beginning to be felt; and we have by no means reached finality. If we continue such investigations, and lose no time in perfecting our sales organizations—which admittedly in many cases could be vastly improved—the public's prejudice against coke, which is already weakening, will disappear. Even if coke fires do not produce flames, there is more in coke than meets the eye.

Hot Water on Tap

The use of coal for producing hot water in the modern home—whatever the size of the home—is dying. Both coke and gas can now be applied, and which it is desirable to employ depends upon local circumstances. Also, what form of gas apparatus it is best to install depends equally upon particular conditions. One of the greatest points in favour of heating water by gas is that our Industry possesses a remarkable selection of apparatus. There is, in fact, a water heating appliance for every type of job; and for the ordinary small household the greatest development of recent times is the low-consump-

tion storage heater. Perhaps "heat accumulator" would be a more useful term. This appliance has many important advantages, chief among which are the facts that normally no flue is necessary and that no alteration is needed in existing supply pipes and meter equipment. Moreover, the cost of installation is very small, and the load is one of the most valuable types which the Gas Industry can have as far as gas manufacturing and storage plant is concerned. A further point about the "accumulator" is the satisfaction which the consumer undoubtedly derives from the knowledge that *hot* water is on tap at all times, provided he or she understands the capacity of the apparatus, and that this hot water on tap will cost a definite and reasonable amount each day, each month, and each quarter.

This is not the first time we have emphasized the desirability of installing gas-heated storage hot water apparatus on every appropriate occasion; and there are many appropriate occasions. We have also called attention to the methods adopted by various progressive undertakings to cultivate this basic load. Our readers will remember, for example, the pioneer efforts of the Halifax Gas Department in their slogan, "Fourpence a day is all you pay"—a slogan which has been translated into excellent effect. Of course, Halifax is not the only concern to adopt live methods of salesmanship in this direction; and among other progressive undertakings in this respect is the Lytham St. Annes Gas Department. We mention the latter because recently the Engineer and Manager, Mr. J. H. Ranft, in an address to the Lancashire District Gas Salesmen's Circle, left none of his hearers in doubt about his convictions concerning the virtues of gas storage heaters in combating electrical water heating appliances. To put it briefly, he believes that in storage water heating by gas lies the only real remedy against the encroachment of electricity in this field of domestic service. He believes, too—and we share his opinion—that every facility should be given to the consumer to adopt this class of service—easy hiring terms, special tariffs for gas, and expert concentrated salesmanship. Mr. Ranft's address will be published in full in the next issue of the "Gas Salesman," while in the "JOURNAL" "Service Notes" to-day will be found interesting extracts from his remarks, which are well worth studying, just as his practice in his own area is well worth emulating.

CORRESPONDENCE

Gas and Foreign Competition

SIR,—Mr. Keillor's letter raises the interesting question of what is meant by competition. Competition is restricted by some to that encountered by the producer due to the importation of foreign produce. No appreciable quantities of coke, tar, or sulphate of ammonia are imported into this country.

The word "competition" may also be used in a wider sense; every article, however produced, is subject to world competition. Coal, gas, electricity, tar, sulphate of ammonia, coke, and benzole are all affected, and in my opinion this form of competition cannot be regarded as a handicap to the Gas Industry which is not shared by other fuel-producing industries. If the British collieries, for example, cannot produce coal cheaper than that at which the foreigner can produce it and send it to England, they will have to meet foreign competition in this country. That is obvious. But if they cannot produce coal cheaper than foreign coal, they will likewise have to meet an indirect form of competition, in that the British coal-using industries, being handicapped through high fuel charges, are driven out of the market. Exactly the same reasoning applies to electricity and to gas. Both are forms of energy, and in many cases both are supplantable or interchangeable with power derived by other methods from coal or oil, and, if not produced below a certain figure, they cannot be sold to British manufacturers. This figure will vary with different industries and districts, but it undoubtedly sets a limit upon the activities of all fuel industries.

Indirect competition operating through the Sulphate of Ammonia Federation and the tar distillers is at its fiercest in sulphate of ammonia and tar products which have to be sold in foreign markets. This is probably the form of competition which Mr. Keillor has in mind, and it has lowered the net revenue obtained at gas-works by about 2s. per ton of coal carbonized—*i.e.*, about ¼d. per therm, a figure which amounts only to about 3 p.ct. of the average selling price of gas. On the other hand, world competition has reduced the price of crude gas oil and of gas coal, so that in my submission the net result is that the Gas Industry does not suffer in cost of production from foreign competition, but rather is assisted thereby.

"THE 'JOURNAL' CONTRIBUTOR."

April 24, 1931.

PERSONAL

RETIREMENT OF SIR FRANCIS GOODENOUGH, C.B.E.

It is announced that Sir Francis Goodenough, C.B.E., is about to retire from the Gas Light and Coke Company.

Sir Francis has had a long and honourable career with the Company, having been in its service for 43 years, during the last 28 years as Controller of the Gas Sales Department.

Ever since the formation of the British Commercial Gas Association he has acted as Chairman of the Executive Committee, and his retirement from the Gas Light and Coke Company, we understand, will not mean his loss to the Industry. It is hoped that he will continue his long connection with the B.C.G.A., and that relief from his departmental duties connected with the Gas Light and Coke Company will enable him to devote even more time to work for the Industry as a whole.

FORTHCOMING ENGAGEMENTS

May 1.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Annual Meeting at the Westminster Technical Institute.

May 1.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.—Meeting in Newcastle.

May 2.—WALES AND MONMOUTHSHIRE JUNIORS.—Annual Meeting in Cardiff.

May 2.—WESTERN JUNIORS.—Annual Meeting at Frome.

May 7.—B.C.G.A. Midlands District Conference at Shrewsbury.

May 14 and 15.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Spring Meeting at Wisbech.

May 15.—SOUTHERN ASSOCIATION.—Visit to the works of the Tottenham and District Gas Company.

May 19.—SOCIETY OF BRITISH GAS INDUSTRIES.—Annual General Meeting in London, under the Presidency of the Right Hon. Lord Eustace Percy, M.P. Council Meeting in the morning.

May 20.—BRITISH COMMERCIAL GAS ASSOCIATION.—Meeting of General Committee, 2.30 p.m.

May 21.—MIDLAND ASSOCIATION.—Meeting at Wellington.

May 21.—WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION.—Meeting at Cardiff.

May 28.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1.

June 2-4.—INSTITUTION OF GAS ENGINEERS.—London Conference.

June 3.—ASSOCIATION OF STATUTORY INSPECTORS OF GAS METERS.—Annual meeting at the County Hall, Westminister Bridge, 10.15.

June 30.—NATIONAL GAS COUNCIL.—Thirteenth Annual General Meeting.

Sept. 28-30.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual Conference at Exeter.

Oct. 27-28.—INSTITUTION OF GAS ENGINEERS.—Autumnal Research Meeting.

THE NEWS OF THE WEEK

A Successful Gas Exhibition has been held in the Cleckheaton Town Hall. Miss E. Eccles was the cookery demonstrator.

Masham (Yorkshire) Urban District Council, on April 23, agreed to a reduction in the price of gas, as from April 1, to 5s. per 1000 c.ft. This is the second reduction since last June.

The Marlborough Gas Company are holding cookery lectures on April 29 and 30 and May 1, afternoons and evenings, in the Town Hall, Miss Ethel L. Webster being the demonstrator.

Negotiations are in Hand, it is understood, for the acquisition by the Birkenhead Gas Department of the Neston and Parkgate Gas Company, Ltd., and the Birkenhead Gas Committee have made an offer of a sum for this purpose.

New Gas Showrooms are in course of erection at Walsall. The showrooms, which are being built at a cost of £4500, will comprise a one-storey building, and it is anticipated that they will be ready for use within the next six months.

Cookery Demonstrations in connection with the Chester United Gas Company were given last week by Miss E. D. Crossland at the Company's Showrooms in Northgate Street. The demonstrations, which were much appreciated, were largely attended.

"Fresh Air and Ventilation" is the subject of the B.C.G.A.'s "Fairy Gas" Competition essay this year, and no more important aspect of home hygiene could have been selected. The essay is the competition task for children over 12; other interesting educational tasks are set for younger children.

Prof. F. W. Burstall, in his quarterly report on the quality of the gas supplied by the Birmingham Gas Department, states that the average calorific value for the whole of the four stations, based on the number of tests as laid down by the Gas Referees, is 475·7 B.Th.U. per c.ft. The declared value of the gas is 475 B.Th.U.

A Proposal to Acquire the undertaking of the Blyth Gas Company was defeated by 17 votes to 13 at a special meeting of the Blyth Town Council. The details of the proposal to purchase were not made known, but it was stated that it was understood that the price likely to be asked by the Gas Company was a prohibitive one.

The Long Eaton Gas Company have made arrangements to take over the Kegworth Gaslight and Coke Company, Ltd. The Kegworth Company was formed in July, 1865, and supplies Kegworth Parish and customers in the village of Kingston-on-Soar, including the Hall, residence of Lord and Lady Belper, and the Midland Agricultural College, Sutton Bonington.

The Gas Supply Company, Ltd., of Melbourne, have declared an interim dividend, payable on March 31, at the rate of 7 p.ct. per annum for the half-year ended Dec. 31, 1930. The output of gas compared with the corresponding period of 1929 decreased by 9 p.ct. This, together with reduced prices for bye-products, and considerably increased charges for taxation, has reduced the amount available for dividend.

The Southern Association will visit the works of the Tottenham and District Gas Company (of which their President, Mr. H. C. Smith, is Engineer) on the morning of May 15. After luncheon at Woodall House, on the invitation of the Chairman and Directors of the Company, the members will be afforded the opportunity of visiting the Edmonton Works of Messrs. Glover & Main, Ltd., where tea will be served.

A Reduction in the General District Rate from 11s. 9d. to 11s. has been made possible at Penrith to some extent, by absorbing £800 of the profits made on the Council's gas-works. In addition, the Gas Committee have reduced the price of gas from 3s. to 2s. 10d. per 1000 c.ft. It was mentioned at the special meeting of the Council that Penrith, which is purely a residential town, has one of the cheapest gas supplies in the North of England.

Rochdale Housing Scheme.—A proposal of the Rochdale Corporation Housing Committee to make the 260 houses to be built at Belfield "all-electric" was questioned at a meeting of the Town Council. It was argued that people going into them were already using gas appliances, and if the houses were to be "all-electric" the gas appliances being used on the hire system would have to be returned to the Gas Department. After a long debate it was decided to install both electricity and gas.

The Coventry Gas-Works Distribution Department held their first annual dinner on April 20, presided over by Councillor H. H. Cheshire (Chairman of the Gas Committee). The company included Mr. P. N. Langford (Engineer and General Manager) and Mr. C. F. Tooby (Works Manager). Mr. Langford, on behalf of the Distribution Department, presented an inscribed set of drawing instruments to the Assistant Distribution Superintendent (Mr. A. R. Langford) upon his leaving Coventry to take up a similar post at Plymouth.

A Holophane Conference was held at Elverton Street, Vincent Square, S.W. 1, on Wednesday, April 15, at which there was an attendance of over 60. The programme followed the usual procedure of addresses by experts in various branches of lighting, together with illustrations by means of lantern slides. Among the speakers were Mr. J. S. Dow, Secretary of the Illuminating Engineering Society, who spoke on the subject of recent developments in illumination, and also Dr. S. English, who dealt with the manufacture of Holophane glass.

Nottingham Gas Frauds.—On Friday last the General Purposes Committee of the Nottingham Corporation sat for many hours at the Guildhall, when much evidence was heard, there being 26 officials and workmen who were alleged to be implicated in receiving gifts. As to the Committee's findings, an official intimation was afforded that nothing would be divulged for the purpose of publication before a report had been presented to the City Council. It is certain, therefore, that the last has not yet been heard of the scandals arising out of the frauds.

Eastern Counties Gas Managers' Association.—The Spring Meeting of the Association is to be held at Wisbech on May 14 and 15, under the Presidency of Mr. J. Green, who is Manager both of the gas-works and the water-works at Wisbech. On the first-named day, Mr. H. R. Thomas, Assistant Manager to the Cambridge University and Town Gas Light Company, will read a paper on "Coal Handling Plant Construction at the Cambridge Gas Company's Sidings;" while on the 15th members and visitors will be the guests of the Wisbech Water-Works Company.

A Week before the Cup Tie, London gasworkers played a "Cup Tie" of their own when the teams of the two leading companies met for their fifth annual match at the Metrogas Amateur Sports Association's ground, Horn Lane, East Greenwich. The representative teams were selected from sixty-three elevens of the South Metropolitan Gas Company and of the Gas Light and Coke Company. The Gas Light team, with a strong wind in their favour, led at half-time by two goals to *nil*. In the second half, however, the Metrogas team succeeded in equalizing through S. Rimmer.

Imperial Continental Gas Association's Dividend.

The Board of the Imperial Continental Gas Association have resolved:

(1) That, subject to the approval of the proprietors and the verification of the accounts by the Auditors, a final ordinary dividend on the £2,800,000 capital stock be paid on May 22 next, for the year ended March 31, 1931, to proprietors registered in the books at the close of business on April 27, 1931, at the rate of 12½ p.ct. (actual), less income-tax, making with the interim dividend of 7½ p.ct. (actual), less income-tax, paid on Nov. 15, 1930, a dividend of 20 p.ct. for the year.

(2) That the General Meeting be held at Winchester House, E.C. 2, at noon on Wednesday, May 20 next.

(3) That the capital stock transfer books be closed from April 28 to May 11, 1931, both days inclusive.

Gas Allowed Fair Play at Mold.

A municipal controversy which created lively and widespread interest in South Flintshire has taken place in the Mold Council Chamber, and out of which the Mold Gas Company successfully emerged. The controversy had its origin several months ago when the Council, by resolution, debarred the tenants of a new housing scheme from having a gas supply. The Council, who own the electricity undertaking, made it a condition of tenancy that the houses should be all-electric.

Then came the elections, which saw numerous new councillors being returned whom, it was known, were in favour of freedom of the subject. The new Council, which met on April 21, had before them at their first meeting a notice of motion by Councillor M. Roberts to rescind the resolution. Mr. Roberts contended that the sole purpose of the old Council was to keep out their competitors, the Gas Company, and their minds were so fixed on it that his arguments that the tenants should have freedom of choice were disregarded. The attitude of the Mold Council was un-British and the resolution passed by the old Council was a blot on their record. He appealed to the new Council to redeem that blot by supporting the motion.

In seconding the motion, Councillor Oscar Jones said that in prohibiting the use of gas while compelling the tenants to pay for, even if they choose not to consume, electric current under the all-in tariff, they were not only tyrannically taking advantage of the extreme need of the homeless, and depriving them of their individual freedom, but despotically subordinating and limiting the privileges of the tenants for the benefit and profit of their electrical undertaking. In other words, the commercial success of an undertaking was of more importance to them than were the rights and privileges of citizenship.

When the motion was put it was carried by 10 votes to 4.

Lives or Lights?

Alarm at Growing Toll of the Roads.

The startling increase in the number of people killed and injured in road accidents, just revealed by the Home Office, is causing grave concern among Local Authorities, who are frequently blamed for the loss of lives in their districts.

"The remarkably low number of accidents occurring in the roads of South London and Kent, in spite of the heavy traffic which they carry, is a tribute to the safety methods adopted by the authorities in these areas," said Mr. H. T. Chapman, M.Inst.C.E., the Kent County Surveyor at Maidstone, last week. "Kent has for long been noted for its extensive use of safety-first road signs, such as clear directional indicators and red danger reflectors on telegraph poles, and for wide non-skid roads as well as for efficient lighting."

"Lives or Lights" has been the motto of the authorities both in South London and in Kent, where all the principal centres are lighted by gas; and local authorities in these districts have expressed great satisfaction at the fact that the number of fatal accidents in towns in these areas did not in any instance reach double figures for the period covered by the report.

Following the tests at Lewisham in which high-pressure gas lighting was found to be the best and safest form of street lighting, overhead gas lighting has been installed on the majority of the main roads leading out of South London; and to this is attributed the steady decline of road accidents in those parts.

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British Commercial Gas Association.

Programme of Midland District Conference.

The following programme has been arranged for the "B.C.G.A." Midland District Conference to be held on Thursday, May 7, in Shrewsbury, under the Presidency of Mr. H. J. Hearn, J.P., Chairman of the Shrewsbury Gas Light Company.

MORNING SESSION.

The Castle.

11. 0 a.m. Welcome by His Worship the Mayor of Shrewsbury (Alderman W. Gowan Cross).
Opening remarks by the President of the Conference.
Paper entitled "Gas for Water Heating," by Mr. A. H. Barker, M.Inst.C.E., B.Sc., Wh.Sc.
Discussion to be opened by Mr. H. J. Woodfine (President of the Midland Association of Gas Engineers and Managers).

1. 0 p.m. Adjournment for luncheon at Morris's Café, Pride Hill (opposite G.P.O.).

AFTERNOON SESSION.

St. Mary's Hall.

2.30 p.m. Public Conference.
Opening remarks by the President of the Conference.
Subjects for discussion:
(1) "Atmospheric Pollution in Relation to Health," by Dr. R. Veitch Clark, M.A., M.B. (Medical Officer of Health, City of Manchester).
(2) "Contribution of the Gas Industry Towards Reducing Atmospheric Pollution,' by Mr. C. M. D. Belton, A.M.Inst.C.E., A.M.I.Mech.E., F.C.I.S. (Engineer and Manager of the Shrewsbury Gas Light Company).
Discussion: Open to the public.

4.30 p.m. Tea.

Society of British Gas Industries.

A Meeting of the Council was held at 56, Victoria Street, Westminster, S.W. 1, on April 16—Mr. FRANK WEST, the Chairman, presiding. Those present were: Dr. E. W. Smith, Messrs. C. A. Goodall, F. C. Tilley, W. H. Handley, B. B. Waller, R. J. Milbourne, H. M. Thorton, F. J. Gould (Hon. Treasurer), George Ewart, Ernest West, E. J. Davison (Hon. Secretary), T. A. Clapham, L. Hartley, and A. L. Griffith (Secretary).

Apologies for absence were reported from Messrs. D. M. Gibb, E. J. Fox, C. R. F. Threlfall, R. B. Hodgson, D. W. Turner, T. O. Wilton, and Col. E. A. Wilson.

The Council approved the proposal to organize a Joint Gas Conference in connection with the Gas Industries Section of the British Industries Fair, Birmingham, 1932. Mr. Frank West, Dr. E. W. Smith, and Mr. E. J. Fox were appointed the Society's representatives on the Joint Gas Conference Committee.

The Council's Report for 1930-31 was submitted, amended, and approved.

The arrangements for the Annual Meeting and Dinner at the Hotel Metropole, London, on May 19, were reported.

Sir Francis Goodenough at Hastings.

The Hastings and St. Leonards Borough Association were fortunate in securing as the principal speaker at the 51st Annual Meeting Sir Francis Goodenough, C.B.E. The meeting was held at the Town Hall on April 24, and there was a crowded attendance.

The chair was taken by the Mayor, Councillor G. H. Ormerod, J.P., who was supported on the platform by the Deputy-Mayor, Councillor H. E. Johnson, J.P., Sir Henry Lunn, J.P., M.D., Mr. Charles F. Botley, M.Inst.C.E., M.Inst.Gas E. (Engineer and General Manager of the Hastings and St. Leonards Gas Company), Mr. E. W. Amore, Chairman of the Association, Mr. C. Grasemann, Public Relations Officer of the Southern Railway Company, and the Secretary of the Association, Mr. W. H. Dyer.

Previous to the meeting Sir Francis was the guest of the Association at an informal dinner held at the Albany Hotel, where the Mayor, the Deputy-Mayor, Mr. Botley, Mr. Grasemann, and others were present to do honour to the occasion. A number of excellent posters, &c., illustrating the work of the Association, were exhibited in several rooms of the Town Hall, and proved of great interest.

Sir Francis in the course of his absorbing Address animadverted on the vital necessity in any business undertaking of cultivating a friendly relationship with potential clients. The commodity for disposal should, of course, be good, but however perfect it was in quality and price, it could not sell itself. Lack of attention to salesmanship had been the mistake of many business houses. The best brains were always applied to problems of production; but as to marketing, the mistaken notion too frequently was

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that it could look after itself. The worst economy was that of cutting down costs of advertising. Young men with university training entered on the production side of business, but few gave a thought to the necessity of training for the selling side. Sir Francis had been asked how he would proceed if he received the appointment of Business Manager to the Borough of Hastings, and he had inquired what the capital would be that he would have to deal with. He understood that eighteen million sterling was the value of the Borough, and he unhesitatingly said he would certainly recommend the expenditure of £40,000 in judicious advertising of its goods—viz., its natural beauty, its many advantages as a health resort, its music, its excellent municipal administration and existing Borough Association, &c. The Association's balance-sheet for last year showed that a much less sum than that had been laid out. It was not until a few thousands had been spent that results would begin to appear, and then the process had to be continued and increased. It was indeed a folly to reduce expenditure on propaganda during times of depression. At that period more than ever the public required to be reminded of the existence of any business, and the value of the goods displayed, and they must always be displayed to the best advantage. The best men of business were those who were never satisfied with the results they achieved, but who were ever on the *qui vive* to improve their turnover.

The vote of thanks was proposed by Sir Henry Lunn, and supported by Mr. Botley.

Increase in Imported Road Material.

Transport Ministry to Take Action.

In spite of the appeal made by the Minister of Transport to local authorities to use British materials for the making and repairing of roads, the Board of Trade returns, published on Wednesday, April 15, show that last month 18,690 tons of bitumen were bought from foreign sources—principally the United States and Mexico—compared with 7741 tons in the same month last year. Local authorities have already spent over £200,000 on foreign road material this year.

It was stated recently that the Minister of Transport intended in the future to make Government grants for road construction conditional upon British products being used, except where local surveyors could satisfy him that it was impossible or undesirable to do so.

Jubilee Celebrations of the Society of Chemical Industry.

Leading scientists from all over the world are to attend the Jubilee Celebrations of the Society of Chemical Industry, which will take place in London during the week commencing July 13, under the patronage of His Majesty the King. The proceedings will be under the Presidency of Sir Harry McGowan, President of the Society, and will comprise a wide programme of scientific discussions, social functions, and visits to industrial centres. Several hundreds of the Society of Chemical Industry's 7000 members are to attend from overseas, and the celebrations will open with a Reception by the Lord Mayor of London at the Guildhall.

The Annual General Meeting of the Society will be held in the Duke's Hall, Marylebone, on Tuesday, July 14, when Sir Harry McGowan will deliver his Presidential Address. In the afternoon a Garden Party arranged by the Shell Royal Dutch Oil Group will take place at Teddington. Wednesday will see the presentation of the Society's Medal to Dr. Herbert Levinstein, and the Annual Dinner at the Great Central Hotel. On Thursday evening a Reception is to be given by the President at the Savoy Hotel.

During the Celebrations Honorary Membership of the Society—a very rare distinction, only previously awarded on six occasions during the fifty years of the Society's existence—is to be conferred on representative leading members of the chemical industry in each of the world's principal industrial countries, and a feature of the proceedings will be the delivery of addresses by these distinguished scientists on various days during the Celebration Week. In addition there will be meetings for the reading and discussion of papers, lectures, and addresses, and an interesting meeting at the Great Central Hotel when papers presented by the Canadian Sections of the Society will be read.

A very wide selection of works and factory visits—including one to the South Metropolitan Gas Company—will be available for members of the Society.

Throughout the week of the celebrations a comprehensive Exhibition of British Chemical Plant and Research and Recording Instruments, arranged by the British Chemical Plant Manufacturers' Association in co-operation with the Chemical Engineering Group of the Society of Chemical Industry, will be held at the Central Hall, Westminster.

The social side of the occasion has not been neglected, and there will be motor drives, river trips, visits to Oxford, Windsor, Eton, Hampton Court, and the Zoological Gardens, and conducted tours through London.

More extensive details as to the Exhibition of British Chemical Plant may be obtained from the Secretary of the British Chemical Plant Manufacturers' Association, Mr. J. Davidson Pratt, O.B.E., 166, Piccadilly, London, W. 1.

Cookery Demonstrations at Plymouth.

Under the auspices of the Plymouth and Stonehouse Gas Company a series of free cookery lectures and demonstrations was given recently at St. Matthias Hall, Plymouth, by Miss H. H. Tuxford, M.C.A.

Opening the series Mr. R. J. H. Clark, the Plymouth Gas Company's Engineer, extended a cordial welcome to the large audience on behalf of the Directors of the Company. He said that the Company's forty-four thousand consumers used over thirty-seven thousand gas cookers, and the number of these was increasing. It was therefore to their mutual advantage that the best results should be obtained from the apparatus, and it was primarily with that object that the lectures and demonstrations had been arranged. He said there was no doubt that gas was and would remain the universal medium for cooking.

One of the most interesting of Miss Tuxford's demonstrations was the cooking of a household dinner, sufficient for six persons, consisting of roast beef, batter pudding, baked potatoes, green vegetables, cocoanut custard pudding, and Welsh cheesecakes, with one pennyworth of gas.

New Scale of Charges at Dunfermline.

In last week's "JOURNAL," p. 213, we published the new scale of charges for gas which will come into force at Dunfermline on May 16 next. We also quoted the "Dundee Advertiser" to this effect:

"Councillor Milligan, Convener of the Gas Committee, stated that the intention of the scheme was to stimulate consumption and to encourage the installation of additional gas appliances, such as fires, &c. Fully 3000 ordinary consumers would pay less for gas under this scheme as their consumption stood at present. They were faced with increasing competition with electricity. They could produce 15 million c.ft. with no additional actual cost.

"Mr. Campbell, the Gas Manager, stated that only about 600 small industrial consumers would have to pay more for their gas as the result of the scheme."

Mr. James Campbell points out that there are three inaccuracies in the foregoing paragraph: "15 million c.ft." should read "150 million c.ft.;" "actual cost" should be "capital cost;" and "600 small industrial consumers" should be "100 small industrial consumers."

Gas Developments at Lincoln.

In about six years' time, we understand, the gas-making plant at Newland Gas-Works, Lincoln, will be closed down, after being in use for well over a century.

This will be necessary, states the "Lincoln Chronicle and Leader," under a Board of Trade Order, and, in consequence, the capacity of the Bracebridge Gas-Works will have to be increased considerably, not only to meet the shortage due to the closing of Newland Works, but also to cope with the steady increase in consumption which is being experienced. It is anticipated that the production of gas at the Corporation Works this year will show an increase of over 10 million c.ft.

For a few years very little has been spent on the plant, so that the works have not been kept up to date. During the next few years, therefore, the city will necessarily be involved in a somewhat heavy expenditure for a comprehensive scheme of reconstruction. No additional capital has been created since the undertaking was purchased, and in 1935 the whole of the original capital loan liability will have been discharged.

The Corporation are now faced with the problem of practically re-building the works, and the first part of the new scheme—a vertical retort stack—was considered by the Council in Committee on Monday of last week. The building of this section will occupy about two years. The remainder of the plant will then have to receive attention.

Prior to their deliberations on this scheme, members of

the City Council, together with Corporation officials, made a tour of the Lincoln Corporation Gas-Works at Newland and Bracebridge. At Bracebridge they saw a new three-lift spiral-guided gasholder in course of erection, with a capacity of 1,500,000 c.ft., as compared with the total capacity of 1,190,000 c.ft. of the existing five holders at Newland and Bracebridge.

The Lincoln Corporation purchased the works in 1885 from the Gas Company (which introduced gas into Lincoln in 1830). At that time the output was 163 million c.ft., there were only 5789 consumers, and the length of the mains was 35 miles. The price of gas was then 13s. 6d. per 1000 c.ft., but the Corporation were able to reduce this figure to 2s. in 1913, while to-day the price is 3s. 6d. per 1000 c.ft. The annual wage bill is £30,000, while, of the 17,400 consumers 11,036 have gas cookers.

Submerged Combustion.

At a recent meeting of the Institution of Chemical Engineers, Mr. C. Featherstone Hammond read a paper on the concentration of phosphoric acid by submerged combustion, in the course of which he said that the following claims have been established for the Hammond plant for this purpose:

In the production of pure acid, freedom from contamination.

In the concentration of crude acid, long life of equipment due to the fact

(*a*) that the burner casing alone is exposed to corrosive attack;

(*b*) that this is a small part and can be obtained in special steel in the best condition by suitable heat treatment, in contrast to the difficulties of manufacturing satisfactory large built-up structures in such metal;

(*c*) that owing to its small size, for a very large capacity only a small surface is exposed to attack;

(*d*) that very thick-walled casings may conveniently be produced by machining from the solid, thus admitting of considerable attack over a long period before any part becomes unfit for service.

In handling of acid:

(*a*) High yields, with only very small losses by fume;

(*b*) Ability to handle fumes which deposit silica, without the troubles which might put the usual form of vacuum pump out of commission.

In fuel costs, ability to compete, using producer gas, with single-effect conventional evaporators, even assuming the possibility of their use at all in the particular corrosive conditions ruling.

In capital cost, ability to show a favourably competitive price, for evaporating equipment of equal capacity.

With properly insulated plant, he said that no difficulty is presented in realizing thermal efficiencies of above 90 p.ct. on the net calorific value of the fuel gas.

Revision of Leeds Gas Charges.

With a view to improving the financial position of the Leeds Gas Department and extending the consumption of gas, the Gas Committee on April 22 approved a proposed revised scale of charges, which will come before the next meeting of the City Council for confirmation. The chief points in the proposed scale, according to the "Yorkshire Post," are:

No increase in the price of gas consumed to any domestic consumer, but a decrease to all but the smallest consumer. The imposition of a service charge or meter rent, to meet standing charges for inspection, collection, &c. In the case of small consumers, this will amount to 1s. 6d. per quarter.

With the exception of gas used for central heating, all gas consumed will be charged at the same rate, whether for domestic or industrial purposes. The first 5000 c.ft. consumed each quarter to be charged at the rate of 3s. 9d. per 1000 c.ft., as at present. Above this, and up to 16,000 per quarter, at the rate of 2s. 8d., *plus*, in both cases, a service charge of 1s. 6d. per quarter.

It has been realized for a considerable time that the present scale does not offer sufficient inducement to consumers to extend the use of gas for all purposes, and it is hoped that the new proposals will remove what has, in the past, been a serious hindrance to development.

Although there is practically no alteration in the price charged for motive power and furnace work, yet in practice, consumers using gas for lighting, cooking, or heating will gain by being allowed to bulk all gas used on one premises for the purpose of rating. A consumer begins to benefit after 6000 c.ft. per quarter.

Among the new fields which the management have been considering for some time is the use of gas for central heating purposes at special rates, and with this object in view, a scale has been drawn up at prices which it is considered will lead to business. Where such installations replace coal-fired heating systems, it will be a further step in the interests of smoke abatement, which the Corporation are anxious to see moving faster than it is to-day.

The proposed new charges are indicated in the following comparative table:

Consumption per Quarter, 1000 c.ft.	At 3s. 9d. per 1000 c.ft. (Present Rate).	3s. 9d. per 1000 c.ft. to 5000, 2s. 8d. above 16,000 *plus* 6s. per Annum Meter Rent.	Amount of Account per Quarter, including Meter Rent.
	£ s. d.	£ s. d. s. d.	£ s. d.
1	0 3 9	0 3 9 + 1 6	0 5 3
2	0 7 6	0 7 6 + 1 6	0 9 0
3	0 11 3	0 11 3 + 1 6	0 12 9
4	0 15 0	0 15 0 + 1 6	0 16 6
5	0 18 9	0 18 9 + 1 6	1 0 3
6	1 2 6	1 1 5 + 1 6	1 2 11
7	1 6 3	1 4 1 + 1 6	1 5 7
8	1 10 0	1 6 9 + 1 6	1 8 3
9	1 13 9	1 9 5 + 1 6	1 10 11
10	1 17 6	1 12 1 + 1 6	1 13 7
11	2 1 3	1 14 9 + 1 6	1 16 3
12	2 5 0	1 17 5 + 1 6	1 18 11
13	2 8 9	2 0 1 + 1 6	2 1 7
14	2 12 6	2 2 9 + 1 6	2 4 3
15	2 16 3	2 5 5 + 1 6	2 6 11
16	3 0 0	2 8 1 + 1 6	2 9 7

For large consumers (over 16,000 c.ft.) there is a graduated scale based on a charge of 3s. per 1000 c.ft. per quarter, exclusive of the proposed service charge, and for consumption above 5 million c.ft. per quarter the scale decreases from 1s. 10d. to 1s. 2d. per 1000 c.ft. for 20 million c.ft. and over, again exclusive of the service charge. Charges for central heating range from 2s. per 1000 up to 100,000 c.ft. per quarter to 1s. 2d. for 20 millions and over.

British Standard Specification for Test Sieves.

The British Engineering Standards Association has just issued a British Standard Specification for test sieves. The Committee in preparing this Specification have had before them the Standard Sieves of the Institution of Mining and Metallurgy, together with the Standard Sieves Series of the U.S. Bureau of Standards. Particulars of these sieves are given in an Appendix to the Specification.

It has been considered advisable to divide the British Standard test sieves into three series:

(1) Fine-mesh sieves made of woven wire cloth with a size of aperture ranging from 0·0021 in. (300 mesh) to 0·1320 in. (5 mesh).

(2) Medium-mesh sieves made from woven wire cloth with a size of aperture ranging from $\frac{3}{32}$ to $\frac{1}{2}$ in.

(3) Coarse-mesh sieves made from perforated metal plate with a size of aperture ranging from $\frac{1}{2}$ in. to 2 in.

The series of fine-mesh sieves has a screening area varying from 35 to 44 p.ct., and the series is based on a ratio of the fourth root of 2 between linear aperture measurements of consecutive sieves; while in the other two series the increments in size of aperture are simple fractions of an inch.

Any individual user of the standard test sieves would not, of course, use the whole range of sieves, and the sizes of apertures of the fine-mesh sieves are so arranged that they may be readily grouped into four complete series, as follows:

Approximate Size of Aperture in Fractions of an Inch.

1/480	1/400	1/333	1/288
1/240	1/200	1/168	1/144
1/120	1/100	1/84	1/72
1/60	1/50	1/42	1/36
1/30	1/25	1/21	1/18
1/15	1/12	1/10	1/9
1/8	..	..	..

It will be noted that in each group the sieves are so graded that the size of aperture of each sieve is approximately double that of the sieve below it.

In order to simplify manufacture and thus reduce the cost of production, the Committee have considered it necessary to adopt mesh numbers commonly used, and to specify sizes of wire included in the standard wire gauge series,

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or intermediate sizes which are in common use. These restrictions have necessarily limited the choice of aperture dimensions and rendered the progression of the series of fine-mesh sieves slightly less uniform than could have been secured if odd counts and wire sizes had been adopted.

The size of the apertures being the most important feature of the cloth, special care should be taken that it deviates to a minimum degree from the nominal dimensions specified.

The figures given for tolerance on occasional large apertures are very wide, but it is impracticable, in the absence of any reliable data on the subject, to specify closer limits at the present time. They must be regarded as tentative only; the Association trusts that it may have the co-operation of both manufacturers and users in this matter, so that revision of the Specification in the direction of greater accuracy and uniformity of aperture size may be possible after one or two years' experience has been gained. Any information as to rapid methods of measuring the aperture size of woven wire cloth, and as to results obtained upon material supplied under the Specification, should be sent to the offices of the Association.

The many uses to which test sieves are put are so varied that the Committee are unable to specify the material from which they are to be made. For ordinary purposes, though, it is recommended that steel should be used for sizes coarser than 40 mesh and phosphor bronze for the finer meshes.

Copies of the new Specification (B.S.S. No. 410-1931) can be obtained from the British Enginering Standards Association, Publications Department, 28, Victoria Street, S.W. 1, price 2s. 2d. post free.

Start Made with Summer Road Programme.

Work on road-construction, which will give employment throughout the summer to many thousands of men at present on the unemployment register, begins this week all over the country. Already the opening of the campaign has been heralded by the drone of the mechanical drill and the healthy smell of the tar-barrel.

It is estimated that during the next six months £12,000,000 will be spent on the construction and improvement of British highways. In the past the Ministry of Transport has contributed to the maintenance of first-class roads only, but it is now realized that the increase in motor-traffic justifies Government grants towards the upkeep of secondary roads also. This will result in the conversion of many roads which are little more than country lanes into first-class motoring roads.

For some years the Ministry of Transport has been urging that only British materials be used by local authorities, and this year it has been decided that grants from the Road Fund will only be made on condition that home-produced materials, such as stone, tar, &c., be used, to the exclusion of foreign products, unless local surveyors can show good cause for acting otherwise.

The more important motoring organizations have expressed full agreement with the Ministry of Transport's policy, particularly with reference to the use of British tar, which, it is stated, provides a more trustworthy surface.

"Skidding has been the greatest cause of accidents upon our roads in the past," states the Roads Improvement Association (Incorporated) in its annual report for 1930, issued last week. The report includes an appeal to all drivers and pedestrians to show their appreciation of the efforts of the Ministry of Transport and Local Authorities to provide non-skid surfaces, by exercising the utmost care on all occasions.

"Means of minimizing the slipperiness of road surfaces have received special attention during the year," states the report. "It is agreed that everything possible should be done to secure the safety of the pedestrians as well as the travelling public by having road surfaces so constructed as to give the best possible grip to vehicles." The Association points out that considerable success has been met with in the use of lightly rolled stone chippings on tar surfaces.

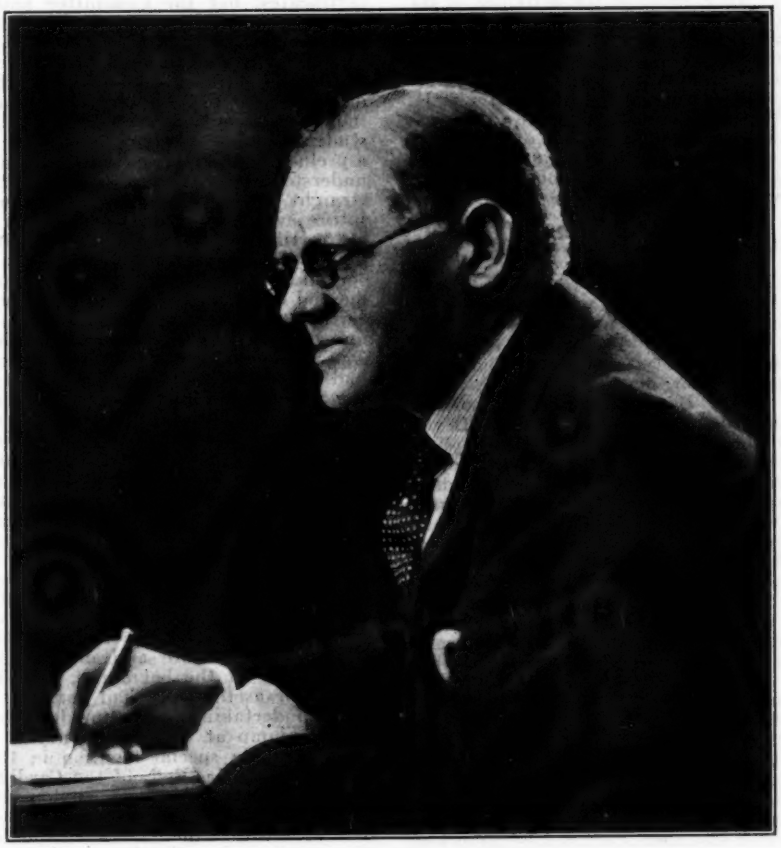
Ideal Home Exhibition at Olympia

FALK STADELMANN & Co LTD
HEAD OFFICE & SHOWROOMS 83-93 FARRINGDON RD. LONDON E.C.
BRANCHES GLASGOW MANCHESTER LIVERPOOL BIRMINGHAM DUBLIN LEEDS NEWCASTLE-ON-TYNE CARDI

Here is a view of the stand of Messrs. Falk, Stadelmann, & Co., Ltd., at this exhibition. In the lighting section the main feature is panel fittings, which are a highly popular form of lighting equipment. Among other cookers shown in the cooking section of the exhibit is the "Newhome" model, which has only recently been introduced by the firm. This cooker has been constructed to meet the demands of the medium-sized family. The firm are also demonstrating their "Spa" water heaters, a description of which was published in the "JOURNAL" for April 15, p. 162.

GAS SALESMEN'S DAY - - - - - - -

A presentation to Sir Francis Goodenough, C.B.E., was an interesting feature of the proceedings at the Eighth Annual Meeting of the B.C.G.A. Gas Salesmen's Circles in London, which was attended by representatives of over a hundred gas undertakings. A full report of the meeting, which included an address by Mr. H. Whitehead on the Education Scheme for Gas Salesmen, will appear in the next issue of the "Gas Salesman."



SIR FRANCIS GOODENOUGH, C.B.E.

A very large gathering of salesmen representing over a hundred gas undertakings from all parts of the country marked the occasion of the Eighth Annual Meeting of members of the British Commercial Gas Association Gas Salesmen's Circles, held in the Caxton Hall, Westminster, S.W. 1, on Friday, April 24, under the Chairmanship of the President of the Association, Mr. John E. Daw, J.P.

Opening the proceedings, the President extended a hearty welcome to all those present, and commented upon the value of the Circles as a means of interchanging ideas and experiences for the good of the Industry. He mentioned that each Circle was entitled to nominate a member to sit on the Executive Committee of the Salesmen's Education Scheme—which scheme was fully discussed subsequently.

Reports of Circle Chairmen.

The Chairmen of the various Circles then gave their reports on the work of their Circles during the past session, and the general inference seemed to point to remarkably successful meetings in all districts, a wide diversity of subjects having been discussed. Mr. W. H. Becket, of the London Circle, mentioned that they had had a number of speakers from other parts of the country to address them at their meetings, and he remarked how valuable this interchange of ideas was to all concerned. Each Chairman commented upon the enthusiasm which attended all their meetings, and the interest displayed in the subjects under discussion. Mr. F. Caudwell, of the Midlands Circle, said that when outlining their Circle's programme for the session, they had taken into consideration the suggestions of Sir Francis Goodenough at the Annual Meeting of Chairmen and Secretaries in July last year; and the questions of thermal storage water heating, development of the industrial load, gas from the woman's point of view, and education for gas salesmen were included. The Midlands Circle had tried the experiment of circulating a questionnaire before their meetings, so that a salesman might come prepared with technical matter to assist him in taking part in the discussion, and so developing his debating powers.

The Lancashire Circle (under the Chairmanship, this session, of Mr. P. H. Christian) seems to be going on from strength to strength, and it was remarked that the average attendances at the meetings had increased. At an early stage in their syllabus they were pleased to have their old friend Mr. W. M. Mason to come to talk to them on the Education Scheme. In Lancashire they have endeavoured to get into closer touch with the gas engineers of the various undertakings. The discussions have afforded sufficient indication of the interest taken in the subjects chosen. Mr. Christian remarked that his own personal thanks and those of the Circle were due to the members of the Committee, who had taken a particularly keen interest in their work.

In spite of the scattered nature of the area covered by the Northern Area Circle, reported their Chairman, Mr. J. R. Hepple, of Newcastle, the work was being carried on with unabated enthusiasm. He enumerated, as did most of the other Chairmen, the various papers which have been read during the session, and added that they were particularly pleased that the paper given by Mr. J. E. White, of Newcastle, had obtained the Medal presented by the Society of British Gas Industries. From the keenness displayed by the members in the discussions arising out of the

various papers, continued Mr. Hepple, it was evident that the meetings were appreciated, and that they afforded an excellent opportunity for the younger salesmen to give expression to their opinions, and so obtain the benefit of the experience of the older members on any difficulties with which they might have to contend.

Mr. J. W. Holroyd, in the absence of the Chairman, Mr. J. W. Carlton, of Shipley, spoke on the work of the West Riding Circle, remarking that they had had a very successful session. The meetings had been remarkably well attended, and a great deal of discussion had taken place—to the benefit, he hoped, of all concerned. They had been specially fortunate during the session in having Mr. Harold Whitehead and Mrs. Cloudesley Brereton to come to speak to them. Mr. J. J. T. Monk spoke of the activities of the Southern District (Sub-Section " B ") Circle, and said that their attendances had been very well maintained. He enumerated the papers read during the session, and voiced the appreciation of the Circle to the directors and managements of the various undertakings in the area. Mr. T. H. Jones, of the South Wales and Monmouthshire Circle, remarked that the session had been successful owing to the generous support of the gas engineers and managers in the area. In conclusion he expressed the hope that the B.C.G.A. Education Scheme would be to the benefit of the Industry.

Presentation to Sir Francis Goodenough.

The President (Mr. John E. Daw) then remarked that he felt that they had conferred a great honour upon him in asking him to take the foremost part in this most interesting procedure at the meeting. " Perhaps it is appropriate," said Mr. Daw, " that I as a Devonian should be asked to show our appreciation, marked by a gift, to Sir Francis Goodenough, also a Devonian, who was born in Devon and spent his early years there, and who left Devon to seek his fortune in the great City of London, where all the talent of the world gathers. Here he met his opportunity, and took advantage of his opportunity—which is the great road to progress. His whole life has been spent in salesmanship, and we look on him as the prize salesman —as well as the father of our Salesman's Circles. Arising out of his work he has been appointed Chairman of the Government Committee on Salesmanship, and received the honour of Knighthood from His Majesty the King in July, 1930. [Applause.] We hope he will be with us many years to watch the success of the Scheme he has formulated; it is for no one to write ' end ' to anything he has commenced."

" We may feel," continued the President, " that Sir Francis has left a permanent record on the educational edifice, and there has been a spontaneous desire that some tangible recognition should be given him of the great honour conferred upon him. It is therefore my pleasing task, on your behalf, to ask Sir Francis Goodenough to accept this beautiful piece of old Irish silver, to testify to the good fellowship which has always existed between him and the Industry we represent."

Mr. H. Wilde (of Bradford) rose to support what the President had said in making the presentation to Sir Francis. He remarked that the senior Association had already made a presentation to Sir Francis, and the salesmen were making this presentation to him on this occasion as Father of the Circles. Mr. Wilde commented upon the splendid work Sir Francis had done towards the cause of improving salesmanship throughout the country, and they were proud to recognize him as the head of their movement, and to be associated with the President of the Association in making the presentation.

Sir Francis Goodenough, acknowledging the presentation, said that he felt it very difficult to express to them his gratitude for their kindness; and if his words were not many, it was rather because his heart was full than because he did not feel very deeply his gratitude to them. " I am indeed proud of the fact," said Sir Francis, " that I had a great deal to do with the foundation of the Salesmen's Circles; I am proud of the fact because of the splendid work that the Circles have done and are doing. I am also very happy to have had something to do with the formulation of the Scheme about which Mr. Whitehead is going to speak to you this morning—the Domestic Gas Salesmen's Course which has just been launched. No better day's work has ever been done for the Industry on the selling side than the preparation and launching of this Course. Those of you who go in for it—and I hope 100 p.ct. of the salesmen in the Industry will go in for it—will enjoy it as well as benefit by it. I want to link it up with the pride I feel in having had something to do with your coming into existence. I very much appreciate the extremely kind speech which my fellow-countryman, Mr. Daw, made in asking me to accept this very charming piece of old silver you have given me. I thank you with all my heart."

The Education Scheme.

The course was then outlined in some detail, and in a very interesting manner, by Mr. Harold Whitehead, who dealt with all phases of the subject, including the method by which they had set about obtaining the information required. (The scheme was outlined in the " Journal " for April 15 last, p. 147; and a full report of Mr. Whitehead's remarks will appear in the next issue of the " Gas Salesman.")

Arising out of Mr. Whitehead's remarks, Sir Francis Goodenough said that it had been asked whether there would be certificates granted in connection with the Course. It would appear that there would not be any certificates; but the Committee had finally decided that certificates would be presented if the results obtained were up to standard; and if the student should have already obtained, either through experience or education, the necessary technical knowledge which every salesman ought to have as a complement to the knowledge of how to sell. The whole Scheme as set out recommended that students should take gas technology and gas economics as a prelude to the Course, but the Committee wished it to be understood that there was no bar to anyone entering straight away for this Course. It was hoped that in the future every salesman would obtain the necessary technical certificate, either through the Institution of Gas Engineers Scheme Minor Course or the Major Course, or the special Course which would enable them to gain a full commercial certificate or the still higher technical commercial certificate. He would emphasize, however, that there was no bar to any salesman entering forthwith for the Domestic Gas Salesmanship Course. The reason why the Committee had arrived at this decision was that in the working out of the Scheme they had found that there was more technical knowledge required in the training course than was anticipated when drawing up the Scheme in the first place. The student could, however, take the course straight away, and obtain the technical knowledge required at a later date. Sir Francis said he would like to take this opportunity of thanking the members of the Committee who had co-operated with Mr. Whitehead and his staff in the preparation of this Scheme. He had given them an idea of the thorough way in which the Scheme had been prepared; the work was very heavy, and they owed them a debt of gratitude for all they had done. The working out of the Scheme had been more and more interesting, more and more practical, and more and more valuable than they had anticipated at the beginning; they had become more enthusiastic as the work had gone on. The result was that those undertakings represented on the Committee were the first to jump at the opportunity of starting the Scheme, and he made special mention in this connection of Mr. Madden and Mr. Bell, of the Cardiff Gas Light and Coke Company, who were very anxious that the whole of the undertaking should benefit by the Scheme. The Directors had agreed that their salesmen should take the Course, the Company paying the fees; and future promotions would depend upon salesmen having taken the Course.

In the course of the discussion which followed Mr. Whitehead's remarks, the question of payment (by those students who had to shoulder the expense of the Course personally) was raised by Mr. Christian, who asked if the six guineas would be accepted in easy payments, or whether it had to be paid in full. In reply, Sir Francis said that such easy payments of the fees would certainly be accepted. It was also asked whether it would be necessary, as had been outlined in the Scheme, for the final examination to be held at the students' own undertakings, and it was suggested that the examination should take place elsewhere. Sir Francis stated that there would be no rigidity in this matter, and it was merely a case of ensuring that the examination took place in the proper manner.

Replying to further questions, Sir Francis said that certificates of the Institution of Gas Engineers and the City and Guilds of London Institute would be accepted in the Scheme as qualifications. Courses in gas technology and gas economics would be provided for by classes where there were sufficient numbers of students to warrant it, but there were also correspondence courses in these subjects for students who could not attend. He would call attention to the booklet issued by the British Commercial Gas Association in connection with the Scheme. In reply to a further question, it was stated that the Course could be commenced by any undertaking at any time.

A vote of thanks to the President was proposed by Mr. W. M. Mason, Manager of the B.C.G.A., for taking the chair at their meeting. He said that this day more or less marked the official launching of the Salesmen's Education Scheme, and it was therefore a matter for congratulation that they should have the President of the Association in the Chair.

Street Lighting by Gas and the British Standard Specification

"Gas Engineers," says the author of this article, "must be prepared to take a very large share in the general movement towards better street lighting, and to help the public lighting engineer in his task of extracting the last ounce of efficiency—as rightly understood—from his installations"

By JOHN W. T. WALSH, M.A., D.Sc.

It must be a source of great satisfaction to all illuminating engineers that so much attention is now being paid to the improvement of street lighting in every progressive town and city throughout the country. There can be little doubt that a not inconsiderable factor in bringing about this very desirable state of affairs was the issue in 1927 of the first specification for street lighting. It is flattering to our national pride, too, that, although the subject has been extensively studied in many other countries, notably the United States of America, it should be left to Great Britain to take this notable step forward. It is not too much to say that the issue of the British Standard Specification for Street Lighting (B.E.S.A. Spec. No. 207—1927) was the beginning of a new era in the efficient illumination of our streets and thoroughfares.

At this point it is well to consider briefly what is meant by the "efficient" illumination of a street. The financial side of the subject is, of course, an important one, but it does not come within the scope of the Specification, or of this article. The lighting engineer's aim is to provide the best possible lighting for the money which is available to him. The standard of lighting in many of our streets is still so low, and the demands created by the ever-increasing volume and speed of modern traffic are so insistent, that for many years to come the public lighting engineer must, if he has a true appreciation of the responsibility of his work, be constantly "asking for more." It is to be hoped that, as the lighting education of the public proceeds, this demand will be treated, not just as evidence of the natural enthusiasm of a specialist in his job, but as a request which must receive the most careful attention and the greatest measure of support possible in the particular circumstances of the case.

Some very interesting figures have recently been compiled by the British Commercial Gas Association, showing that, in 318 large towns, over 13,000 miles of streets are illuminated by gas.* It follows, then, that gas engineers must be prepared to take a very large share in the general movement towards better street lighting and to help the public lighting engineer in his task of extracting the last ounce of efficiency—as rightly understood—from his installations.

It is becoming almost a truism in these days to say that the real efficiency of any lighting system, be it street, factory, home, or office, is no longer a matter solely (or even chiefly) of the illumination obtainable for a given outlay. It is quite easy to increase the average illumination of a street and at the same time to reduce the real efficiency of the lighting.

It cannot be said that there is yet general agreement as to the criteria which should be adopted in judging the efficiency of a street lighting installation. There are many sides to the problem, all of which have to receive due consideration and their proper weight in the final appraisal. The chief matters to be considered are four in number—viz., (i.) the minimum brightness of the roadway, (ii.) the evenness of this brightness (conveniently expressed by the ratio of the maximum to the minimum, or of the average to the minimum), (iii.) the absence of glare, and (iv.) the general appearance of the installation both by night and by day. We may here briefly consider in turn the first three of these factors, for the fourth goes outside engineering and would take us into the realm of æsthetics.

BRIGHTNESS.

First of all it is necessary to distinguish clearly between brightness and illumination. Since the brightness of a surface is equal to its illumination multiplied by its reflection factor, it will be seen that a knowledge of the latter is of great importance. Unfortunately, the reflection factor of a road surface, being dependent on the nature of the surface, is quite outside the control of the lighting engineer. There is one point, however, which is worth noting. Under ordinary conditions the reflection factors of all unpolished surfaces are fairly constant, because the light does not reach them at very large angles to the normal, nor are they viewed very obliquely. In a street, however, matters are altogether different. With a spacing/height ratio (distance between lamps ÷ height of lamps above roadway) equal to 15, the light reaching the point of the roadway mid-way between two lamps is incident at an angle of about 8° to the plane of the road surface. Further, the eye of a motorist is only about 4 to 5 ft. above the roadway, so that the patch of road 100 ft. ahead is viewed by him in a direction which is inclined to the surface at an angle of only 2½° to 3°. Now even the most matt of surfaces will show a marked rise of reflection factor under these conditions, and an interesting series of curves relating to this subject and to typical road-surfaces has recently been published.† One such curve is shown in fig. 1. This relates to tar macadam and shows that for the angles of incidence and view mentioned above (8° and 3° respectively) the reflection factor of this type of road surface is about ten—*i.e.*, the patch of road would appear ten times as bright as a perfectly matt white surface having the same illumination. This curve, of course, refers to dry conditions. It is a matter of common observation that after a fall of rain a number of bright streaks appear between the observer and the various street lamps, showing that the reflection must be regarded as specular; it is therefore quite impossible to make any useful calculations of brightness under these conditions.

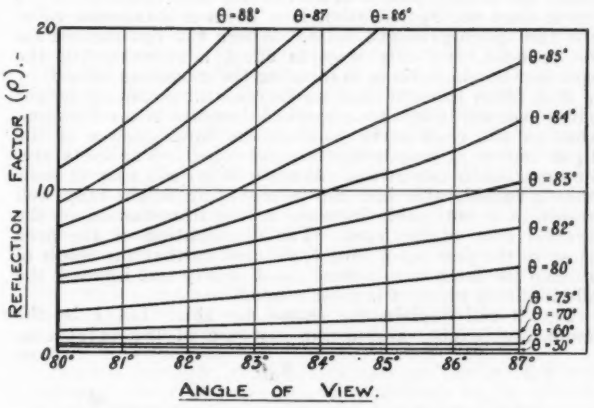


Fig. 1.—Curves of Reflection Characteristics of Rock Asphalt.

It will be seen, from what has just been stated, that the old aim of a uniform illumination of the road surface was quite misdirected. Such a condition would not have produced anything like uniformity of surface brightness. It may, in fact, be said at once that a reasonable diversity ratio in the illumination is certainly permissible, and it has even been advocated as desirable. On the other hand, too great a diversity is definitely bad for two reasons. In the first place, the excessive contrast between the brightness of the bright patches of roadway and the blackness of the dark patches causes the latter to appear as if completely unilluminated, and objects on the roadway at such points are quite invisible. In the second place, it is a matter of

* "GAS JOURNAL," April 8, 1931, p. 86.

† "Reflection from Road Surfaces," by A. K. Taylor. Illumination Research Technical Paper No. 9. H.M. Stationery Office, 1930.

common observation that it is much more difficult to detect an object if it is viewed against a background of alternate black and white streaks than if the contrast between the different parts of the background is reduced. Since pedestrians on the roadway, and other vehicles, are viewed against the road surface as a background, it follows that an excessive diversity ratio will give much poorer visibility.

It is for reasons such as those given above that in the British Standard Specification for Street Lighting the value of illumination measured is that at a point where it may reasonably be expected to be a minimum; in fact, it is laid down that " the illumination at any part of the ground . . . shall not be substantially less than the illumination prescribed for the test-points in the foregoing clauses." In other words, the illumination considered in the Specification is the *minimum* illumination, or something very near it. No mention is made of the diversity ratio as such, but this will probably be taken care of by the very fact that the minimum is prescribed. It will be natural for the designer of an installation to do his best to bring the minimum illumination to as high a value as possible. In so doing he must almost certainly reduce the diversity ratio, for a high diversity would mean that the light was being inefficiently distributed and that some ought to be re-directed from the parts where it is in excess to assist in raising the minimum value.

Spacing and Height.

The diversity ratio of an installation can be reduced in two ways. One is the use of optical methods for re-directing some of the light so as to increase the candle-power of the source in directions close to the horizontal. This matter will be referred to again later.

The other method of improving the distribution of light on the roadway is to decrease the spacing and increase the mounting height. The advantage of the former change is immediately apparent. The great drawbacks to it are the necessity for changing the positions of the standards (probably already in existence) and the increased cost, both initial and for operation and maintenance. At the same time, the disadvantages of excessively long spacings are so great that the Specification lays down a maximum value for the spacing/height ratio. Where the spacing cannot be reduced, the only way to effect a reduction in the spacing/height ratio is to increase the mounting height.

It is often thought that an increase in mounting height must necessarily involve a marked decrease in the illumination on the road surface unless the candle-power of the light source is proportionately increased. The facts are, however, quite otherwise. Actually it is quite easy to show that a considerable increase in mounting height may well result in a noticeable increase in the illumination of the central part of the span. The illumination of the area close to the post is, of course, reduced so that the result of raising the lamp is to reduce the diversity and increase the illumination where it is most needed.

Fig. 2 will explain the reason for this. Let h be the mounting height, and d the distance of the point considered, measured from the base of the post. Then, if $d/h = \tan\theta$, and if the candle-power of the source at the angle θ is I, the illumination is equal to $[I/(h^2 + d^2)] \cos\theta$, for the light reaches the road surface at an angle θ and so the horizontal illumination includes the term $\cos\theta$. Since $h = d\cos\theta$. the above expression reduces to $(I/d^2)\sin^2\theta\cos\theta$. Now for the special case when I is the same at all angles up to about 80°—and this is the case of the bare inverted mantle to a fair degree of accuracy—it follows at once that, for any given value of the distance d, the maximum illumination is obtained when $\tan\theta = \sqrt{2}$ — *i.e.*, when $h = d/\sqrt{2}$.* Thus, for a source for which I is sensibly constant, the maximum illumination at the point halfway between posts is obtained when the spacing/height ratio (*i.e.*, $2d/h$) = $2\sqrt{2}$, or 2·82 approx. To obtain such a ratio as this with normal spacing would demand heights which are generally quite impracticable, but the improvement resulting from an increase of height within quite practicable limits is clearly seen from fig. 3, which shows the horizontal illumination curve (in foot-candles), for mounting heights of 15, 20, 25, and 30 ft. The light source is here assumed to be an inverted low-pressure mantle with a polar curve of the form shown in the corner of the diagram.

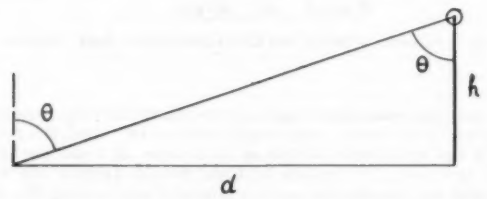


Fig. 2.—Diagram illustrating Effect of Mounting Height of Lamps.

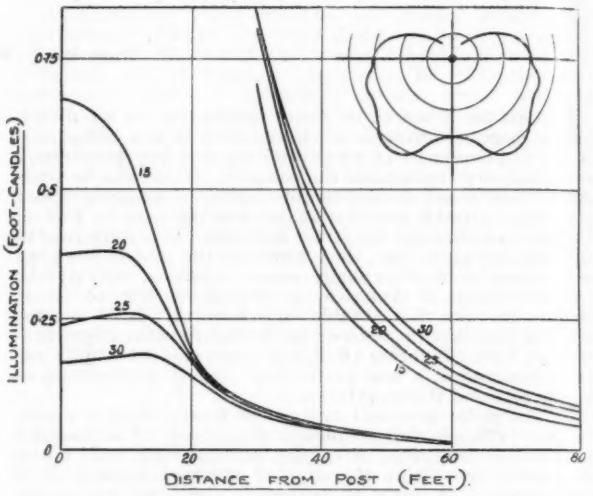


Fig. 3.—Illumination Curves at Various Mounting Heights.

The mounting height in feet is shown against each curve.

The polar curve of the lamps is shown at the top right-hand corner.

A high-pressure mantle approximates to a cylinder of light, so that, except at angles close to the vertical, its polar curve is not represented by I = constant, but by I = constant × $\sin\theta$. In these circumstances, the illumination at a point at distance d is given by $(I/d^2)\sin^3\theta\cos\theta$, and the optimum mounting height is now found to be given by the condition that $\tan\theta = \sqrt{3}$ —*i.e.*, $\theta = 60°$. In other words the best spacing/height ratio for high-pressure gas (without re-directing equipment), is $2\sqrt{3}$—*i.e.*, 3·5. Even this figure is not, in itself, within the range ordinarily attainable, and it follows that, in order to obtain a really good light distribution, some kind of re-directing equipment is necessary. What it is important to emphasize here, however, is that an increase in the mounting height of lamps is desirable in order to increase the illumination at the midpoint and to reduce the diversity ratio of the system.

Glare.

There is another important advantage in increasing the mounting height of street lamps, and that is the consequent reduction in the glare produced for users of the roadway. Glare produces two kinds of effects. In the first place, the presence of a number of bright points of light in the field of view causes a sensation of discomfort and annoyance which reacts unfavourably on the ability to carry out any task, such as driving in traffic. In the second place, the presence of a bright spot in the visual field produces a lowering of the sensitivity of the eye to small contrasts in that field, and it is just those contrasts on which the eye depends to enable it to pick out objects on the roadway after nightfall.

The first of these two consequences of glare—viz., the sense of discomfort—is naturally very difficult to express in any quantitative form, but the second effect, the reduction of sensitivity to contrast, can be measured, and an extensive series of investigations has been made on the subject, and some very interesting results have been deduced.

In the first place, it has been established that the effect of a bright source of light in reducing the contrast sensitivity depends not on the brightness of the source or its size independently, but on the product of the two—*i.e.*, the candle-power in the direction of the eye. This is found to hold for all sizes of source up to limits well above those met with in street lighting. Secondly, the glaring effect depends on the distance of the source from the eye of the observer. Finally, it depends on the distance between the

* Since the illumination = $(I/d^2)\sin^3\theta\cos\theta$ and (I/d^2) is constant, the maximum value of this expression is obtained by differentiating with respect to θ, and equating the result to zero, so that $2\sin\theta\cos^2\theta - \sin^3\theta = 0$—*i.e.*, $\tan^2\theta = 2$. Similarly, when the illumination is given by $(I/d^2)\sin^3\theta\cos\theta$, $3\sin^2\theta\cos^2\theta - \sin^4\theta = 0$, or $\tan^2\theta = 3$.

source and the object to be distinguished. This distance is generally measured as an angle—viz., the angle between (*a*) the line joining the glaring source to the observer's eye, and (*b*) the direction in which the observer is looking. The glaring effect is measured by the difference it produces in the least contrast of brightness which the eye can just perceive. When no glaring source is present, a small patch which is a few per cent. brighter or darker than its background (assumed to be uniformly bright) is just discernible by the average eye. The actual value of this percentage varies with the background brightness, and, further, it is increased by the presence of a glaring source. The amount of the increase depends on each of the three factors mentioned above, and the combined effect can be expressed by the formula $\frac{I}{d^2\theta^3/^2}$, where I is the candle-power of the glaring source in the direction of the observer's eye, *d* the distance of the source from the observer, and θ the angle described above. This expression shows that, for a given value of *d*, an increase in I can be compensated (as far as glare is concerned) by an appropriate increase in θ. Alternatively if I and *d* are both constant, the glaring effect can be reduced by increasing θ.

It is clear at once that an increase in the mounting height of the lamps in a street-lighting installation must increase θ and so produce a corresponding decrease in the glare. For, consider the case of a driver whose eye is 5 ft. above the road level, and who is concentrating his attention on the objects straight ahead of him. When he is just passing a lamp-post, if the spacing is 150 ft. and the mounting height 15 ft., the angle which the beam from the lamp makes with his direction of view is $\tan^{-1}\frac{10}{150} = 3{\cdot}8$ degrees. If, however, the mounting height be increased to 25 ft., this angle becomes $\tan^{-1}\frac{20}{150} = 7{\cdot}6$ degrees. This doubling of the angle θ produces a very marked change in the contrast sensitivity of the driver's eye. Actually it can be shown that, if the average brightness of the road surface (taken as the background brightness) be 0·05 candle per sq. ft. (approximately that corresponding to Class E in the Standard Specification), the percentage difference of brightness just perceptible in the first case (15 ft. mounting) is 2·6 p.ct., while in the second case (25 ft. mounting) a contrast of 1·4 p.ct. is just discernible.* In other words, the sensitivity of the driver's eye to small contrasts in the field of view is nearly doubled by raising the lamps from 15 ft. to 25 ft.

It should be noted that, in making the above calculation, no account has been taken of the effect of any lamps beyond that one immediately ahead of the observer. These will, of course, have a noticeable glaring effect, but the result of increasing the mounting height will again be of the same order of magnitude, so that the point which it is desired to emphasize here—viz., the great advantage to be gained by placing the lamps as high as possible—is, if anything, brought out still more clearly.

It will be noticed that in Clause 14 of the Street Lighting Specification a table of *minimum* mounting heights is given, but it should be clearly recognized that these minima should be considerably exceeded wherever practicable, especially for the lower classes of the Specification. Similarly the maximum spacing/height ratio of 12 referred to in Clause 15 should be regarded as an upper limit which it is always wise to reduce as much as possible.

Re-Directing Equipment.

In order to obtain a lower diversity ratio, and a more even distribution of the light available from a gas mantle, the use of re-directing equipment is now becoming more and more common. Such equipment may take any one of a number of different forms. For instance, a plate of refracting prisms may be placed on each side of the mantle, these prisms being so designed as to produce a much-increased candle-power in directions between (say) 10° and 20° below the horizontal. There are both advantages and disadvantages attending the use of equipment of this kind, and its correct adjustment when it is installed is a matter of the greatest importance. It is impossible to do more than refer quite briefly to the matter here, and a more complete treatment must be reserved for a separate article.

Testing.

A large part of the Standard Specification deals with the question of testing. The object of a test must be, of course, to determine the effectiveness of an installation. Of the four factors in effectiveness which were enumerated above, the only ones which can be conveniently measured quantitatively are the first two as far as these are determined by the illumination of the roadway. Appearance is clearly as much a subjective as an objective matter, depending largely on the taste and æsthetic education of the observer. Glare can, it is true, be measured by special means, and it is possible that at some period in the future it may be practicable to measure the contrast sensitively attainable with any given system of street lighting.† At present, however, test measurements must be confined to the illumination on the roadway, and it remains, therefore, to decide how to make such tests yield the best result at the minimum expenditure of time and money.

The relative advantages of the average and the minimum illumination as a criterion in street lighting have been discussed at great length and for several years, and there is even now no general agreement on the matter, either in this country or internationally. Put briefly, the argument for the adoption of the average is that it is much less likely to be misleading, for the minimum may refer to either a large or a small part of the total area and bears no definite relation to the general level of the illumination over the whole street. The average, on the other hand, does indicate the general level, but it has the great drawback that it is much more difficult to measure, and it does not indicate one very important matter—viz., the illumination at the darkest point.

As stated earlier in this article, the minimum illumination has been adopted as the criterion for the purposes of the British Standard Specification, but in order to avoid the necessity for searching the street to find the position at which this minimum occurs, certain definite points have been specified, where the illumination may be expected to be approximately the minimum with a normal type of light source, and it is laid down that the illumination at five of these points, taken in consecutive spans of the system, shall be the basis on which the installation is judged as regards its conformity with the clauses dealing with illumination.

There are two-and-a-half pages of the Specification which deal with the subject of testing, and it is laid down, among other matters, that the measurements shall be made with a photometer which complies with the requirements of the British Standard Specification for Portable Photometers (No. 230—1925). When the test plate is placed so as to measure horizontal illumination directly it must not deviate by more than half a degree from the horizontal. This is of great importance on account of the obliquity with which the light generally reaches the test-point. It will be seen that even when the light is inclined by as much as 20° to the surface, an error of 1° in the level of the test-plate introduces an error of over 5 p.ct. into the illumination measurements. It is for this reason, too, that the Specification lays down that, when the light reaches the surface at an angle of more than 75° from the normal, the test-surface shall be tilted so as to be perpendicular to the light rays, and the result shall be multiplied by the cosine of the angle of tilt so as to obtain the value of the horizontal illumination.

Several portable photometers now on the market have special devices for enabling the test-plate to be tilted in this way, and for giving the angle of tilt by a simple reading on an angular scale.

Conclusions.

It has only been possible in this article to deal quite briefly with some of the main features of the British Standard Specification for Street Lighting, particularly as they affect gas-lighting installations. The importance of increasing the mounting height of lamps as much as possible, and the desirability of having a low spacing/height ratio has been pointed out. The effect of improvement in these two respects is to give a higher and more uniform illumination on the roadway and to reduce the diversity ratio—*i.e.*, the ratio of the maximum to the minimum illumination. The necessity for reducing glare has been considered, and it has been shown how an increase in the mounting height is again desirable with this object in view. Testing for conformity with the Specification is done on a basis of minimum illumination, as represented by the illumination at a "test-point" in a prescribed position with relation to the lamps.

Finally it cannot be urged too strongly that gas engineers have a very big responsibility and a correspondingly big opportunity in the field of public lighting. The fact that the International Congress on Illumination is being held in England in September of this year should be a further stimulus towards the improvement of lighting systems of all kinds, and among them, the street lighting systems which are so largely the concern of the gas undertakings of this country.

* In making this calculation it has been assumed that the illumination of the road at the point mid-way between lamps is that specified for a Class E street—viz., 0·1 foot-candle—and that the candle-power of the lamp in the direction of the driver's eye is equal to that in the direction of the mid-point on the roadway.

† See the "Illuminating Engineer," Vol. 23, Nov., 1930, p. 279.

GAS SERVICE - - -

Discussed from the viewpoint of the Gas Salesman

Combined Advertising.

When we give consideration to the subject, we find that the association of ideas plays a large part in our ordinary everyday life. We constantly remember one thing by the name or sight of another totally different object, and this suggests a large and almost unexploited field for visual advertising. There is, for instance, what is known as "combined" advertising, the object of which is to influence the public to associate mentally one commodity with another—an idea which would seem so mutually advantageous to the two firms concerned that it is surprising that it has not been taken up more generally. Writing on the subject in the April "Gas Salesman," Mr. Easten Lee developed the theme with a description of a window display he had successfully staged, in which those very well known little people, the "Bisto Kids," were concerned, in one of their adventures, with a gas cooker. Many other possibilities will occur to gas undertakings' display men who wish to try out this method of advertising, the essential being of course to select a well known character from the national hoardings. There should be little difficulty in obtaining permission from the other advertiser, and the fact that he will often have ready-made display material will be helpful.

A Jig-Saw Gas Fire.

Unless a thorough system of inspection is in operation it is difficult to keep track of the gas consuming appliances installed in many homes. So many gadgets are nowadays on sale on all sides that constant vigilance is necessary. Recently in one of the popular chain stores I watched a woman buy a "gas fire" at so much a piece, to be put together like a jig-saw puzzle. I asked the attendant how on earth they were connected to the gas supply, and she replied, "Oh, any carpenter can fix them, but it is easy to do it yourself." I then inquired if many of these fires were sold, and I was snubbed by the obvious reply, "We would not stock them if there was no demand."

A few months ago a caller in the showroom referred to these same fires as handy little things "just to turn on while my lodgers have their breakfasts." A few words to her on the risks she ran of having an accident soon made her realize that false economy in using cheap gadgets might even imperil her livelihood as a boarding house proprietress. A monthly gas magazine or homecraft bulletin, such as Leicester and Cleethorpes and several other gas undertakings distribute, would result in much goodwill and confidence, and help the scheme of education advocated in the "GAS JOURNAL" by "A Retired Gas Engineer." If complaints were encouraged, the householder would feel that the undertaking was able and willing to improve any unsatisfactory gas appliances.

[From the Women's Page in the April "Gas Salesman."]

Water Heating Competition.

The idea seems to be prevalent that the electric water heater is not successful. I can assure you, said Mr. J. H. Ranft, Engineer and Manager at Lytham St. Annes, recently addressing the Lancashire District Circle, that properly fitted it is most successful, it fulfils all requirements, and the maintenance cost is low. The total installation cost including contractor's profit is about £7. Electricity can be bought for water heating at 0·33d. per unit, and 0·5d. per unit is now becoming a universal figure. The average quantity of hot water used daily varies from 30 to 60 gallons, and the costs of this with gas at 9d. per therm and electricity at 0·5d. per unit, using a gas storage heater at 75 p.ct. efficiency and an electric immersion heater at 90 p.ct. efficiency, water raised 90° Fahr., is as follows:

Water Drawn per Day.	Weekly Cost—	
	Gas.	Electricity.
Gallons.	s. d.	s. d.
30	2 9	2 11
40	3 4	3 9
60	4 6	5 3

This means that gas at the flat rate of charge has to compete on equal price terms with electricity charging tariff rates. Under these conditions it is to be expected that our competitors will get a big share of the water heating business. We want and must have special tariff terms, and the sooner our leaders fully realize this the better. We want action not talk.

Suitable Apparatus Now Available.

Why, asked Mr. Ranft, has domestic hot water heating been neglected by all gas undertakings? The principal reasons, in his opinion, are (1) that there was the idea, and perhaps rightly so, that gas could not compete with solid fuel on the ground of cost; (2) that present-day property is fitted with a circulating system heated by back boiler which at least partially gives the winter requirements; (3) that the types of gas apparatus available were high in first cost, installation, and running cost; (4) that the appliances were not always suited to requirements and were difficult to fix satisfactorily.

Under this handicap, a campaign instituted at Lytham St. Annes in 1926 to encourage water heating by a reduction of 25 p.ct. in the price of all gas used by a domestic consumer who installed a gas heated water circulator had most disappointing results, in spite of special advertising, personal letters, canvassing, &c. While little or no headway was being made, electrical contractors had installed water heating apparatus for more than 6 p.ct. of the gas undertaking's consumers with quite satisfactory results, their success being due chiefly to low cost of installation, ease of fitting, and a low tariff for current. It was realized that the types of gas heated boiler on the market were generally unsuitable and that gas undertakings could only compete if they produced a low consumption heater. With the gas thermal storage heater and the immersion heater now available the story is different, and much can be done, even before tariff terms are available, by supplying on all-in terms.

Do All-In Terms Pay?

This question has often been asked, stated Mr. Ranft, and, as his experience has chiefly been with the heating unit connected up to existing cylinders, he gave what he considers a typical instance of the 30 gallon size. The gas was always on.

March quarter	6,900	Coal used every day.
June ,,	10,200	Coal used part time.
September quarter	13,100	No coal.
December ,,	9,300	Coal used part time.
	39,500, say 40,000 c.ft.	

Cost at 9d. per therm, £7 10s.

The price of the apparatus fitted complete is £8 12s., hire 5d. per week, or all-in charge including installation, maintenance, and gas, of:

20 gallon cylinder	4d. per day.
30 ,, ,,	6d. ,, ,,
40 ,, ,,	8d. ,, ,,

At the beginning of the scheme practically all customers installed on the ordinary hire charge on a three years' agreement, but lately 50 p.ct. of new installations are going on the all-in terms. The cost of the appliances including fixing is £7 10s., and the interest and sinking fund on 10 years' loan is £1 0s. 3d. per annum. Gas consumed 40,000 c.ft. per annum.

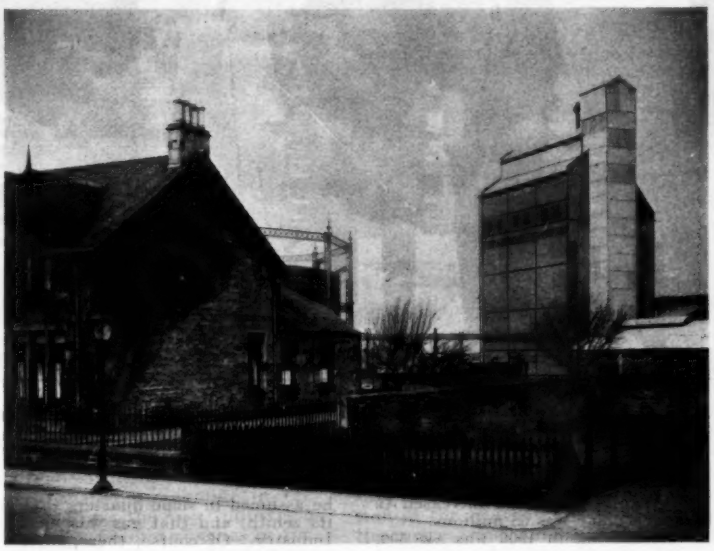
	£ s. d.	
4d. per day	6 1 8	per annum.
Less interest and sinking fund	1 0 3	
Leaving for gas	£5 1 5	

Average cost of gas into holder, 16·34d. per 1000 c.ft.
40,000 c.ft. at 16·34d. = £2 14s. 5d.,

leaving a contribution of £2 7s. per consumer towards distribution and standing charges on top of what you already receive, *i.e.*, practically all profit.

Grangemouth Vertical Retort Installation . .

An account of the official opening on April 21. The new Glover-West plant was described in the "JOURNAL" for Jan. 7, 1931



A VIEW OF THE RETORT HOUSE.

The official opening and inspection of the new installation of Glover-West vertical retorts at the Grangemouth (Stirlingshire) Gas-Works took place on Tuesday, April 21, when a company of Councillors and Officials of Grangemouth and other burghs, and representatives of the Contracting Firm, inspected the works. At the luncheon which followed, Provost J. Burnett White presided, and was supported by Alderman Fred J. West, C.B.E., J.P., Managing Director of Messrs. West's Gas Improvement Company, Ltd.; Mr. H. G. Ritchie, Engineer and Manager of the Falkirk Gas Undertaking and President of the North British Association of Gas Managers; Judge W. S. Sharp and Judge J. Gloag, members of the Gas Committee; the Provosts of Stirling and Bo'ness; Mr. James Taylor, Secretary of the Falkirk and District Development Association; Mr. R. B. Glover, M.C., the Director of Messrs. West's who has been particularly interested in the Grangemouth installation; and a distinguished company of gas engineers and managers.

The PROVOST extended a welcome to the visitors, thanking them for their attendance and support at the celebration of the opening of the extensions and improvements to their gas-works. He regretted the absence of the Convener of the Gas Committee, who was prevented from staying to lunch with them by the exigencies of his business; they had an able substitute in Judge Gloag, himself an ex-Gas Convener.

Alderman FRED J. WEST, proposing the toast of the Grangemouth Corporation Gas Department, said that, speaking with some 26 years' experience as a City Councillor, he found that representatives of the public on municipal bodies frequently received far more criticism than commendation. After long and close observation of municipal government not only in this country but in most parts of Europe, America, Australia, and other parts of the British Empire, he gave it as his considered opinion that there was no country in the world where public service was more efficient, more disinterested, and more progressive than in these Islands.

STEADY INCREASE IN GAS SALES.

In a time of general trade depression it was refreshing to turn to an Industry which, however it might be affected by the vagaries of seasonal weather, maintained a pretty constant growth at a rate something like 3 p.ct. per annum. In fact, the annual make of gas in the British Isles had increased from approximately 190,000 million c.ft. to nearly 330,000 million c.ft. in the last twenty years, or approximately 66 p.ct., while the number of consumers had increased from 6½ millions to nearly 10 millions—or over 50 p.ct.—in the same period.

These figures show no signs of decay, and he might say that he saw nowhere, during his recent tour round the world, any signs that the use of gas was being in any way detrimentally affected by competition with its energetic rival, electricity. In countries where electricity was far more largely used than in the British Isles, one found that the consumption of gas per head of population was often greater than it was at home.

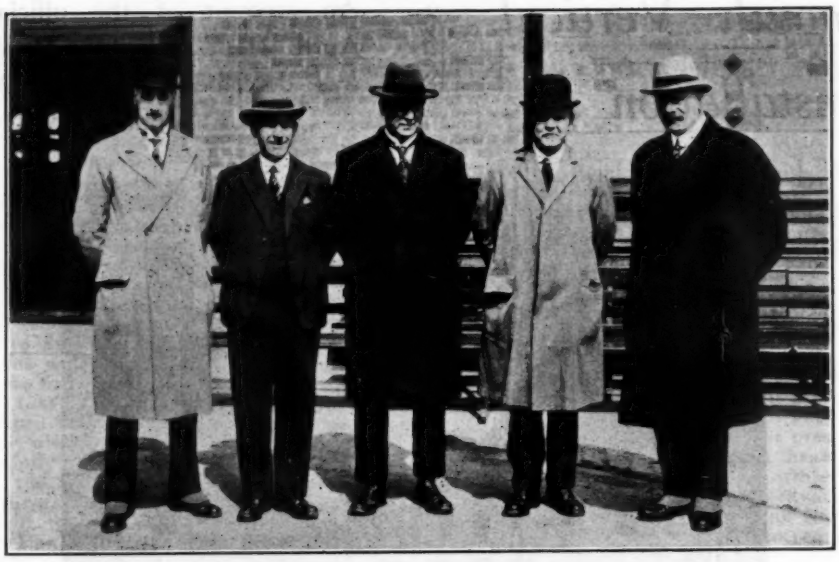
During his tour he spent some weeks in Japan, where he saw side by side with electricity generating stations which would compare in scale and efficiency with anything in the West, gas-works on an even larger scale, and in which the very latest practices of gas manufacture were fully exploited. The quantity of gas made annually by the Tokio Gas Company was larger than that made in Glasgow or Manchester, and was surpassed in the whole of Britain only by the production of Birmingham and some of the Metropolitan Companies.

But it was significant that the continued success of the Gas Industry rested upon a very sure foundation—namely, that of a high and increasing standard of efficiency, an efficiency which has grown with the growth of the Industry. Twenty years ago the average volume of gas made per ton carbonized by the authorized gas undertakings in this country was just over 13,000 c.ft.; to-day it was over 17,000 c.ft. But perhaps a more significant fact still was that this high standard of efficiency was as readily realized in a gas-works of the capacity they had inspected that day as it was in the works of the very largest undertakings. In this respect gas differed, and differed advantageously, from its competitor. The heat efficiency of 25 p.ct. in the generation of electricity was possible only in very large stations, whereas the corresponding figure for the gas-works, in the neighbourhood of 75 p.ct., was as readily realized in Grangemouth as it was in London. Indeed, it was perhaps more readily realized in Grangemouth, where a capable and energetic Manager like Mr. Cuthbert was able to see the whole of his plant with his own eyes, and where he could give personal attention to every detail of manufacture, which was, of course, impossible in a very large installation.

Mr. West continued: "I hope I may be permitted to remark in passing that the continuous vertical retort has placed in the hands of the keen gas engineer an instrument whereby he may secure the full reward of his technical ability. It has removed gas-making from brawn to brain. The new method of gas making is not so readily left to the unguided attention of the workmen as the older plants were. It makes greater demands upon the capacity and abilities of the managers, a point which should be recognized by the Committees and Boards to whom they are responsible, but, on the other hand, it responds far more readily to the skill and attention of properly trained operators and managers."

THE GRANGEMOUTH UNDERTAKING.

Judge SHARP, responding to the toast, gave an entertaining account of the history of the undertaking from 1834, when a Deed of Co-partnery was entered into between several legal gentlemen to form what was then termed a Joint Stock Company. This Company existed until 1890, when it was converted to the usual form of limited liability Company, which carried on the business until 1906, when the undertaking was taken over by the Gas Commissioners. Unfortunately, no statistics were available for the manufacture of gas prior to 1906, but as nearly as could be calculated it would appear that 11 million c.ft. of



From left to right: Mr. H. G. Ritchie (President, North British Association); Mr. A. Cuthbert (Engineer and Manager, Grangemouth); Mr. J. B. White (Provost, Grangemouth); Bailie J. Drysdale (Convener, Gas Committee); Ald. Fred. J. West (West's Gas Improvement Company).

gas was manufactured in 1891. In 1907 this had increased to over 31 millions, and now the year's make was 65 millions.

The purchase price of the undertaking in 1906 was £28,500, and although considerable capital expenditure had been incurred since that year, the policy of the Gas Commissioners had been to write off capital by means of depreciation and sinking funds. How well they had succeeded was proved by last year's Abstract of Accounts, which showed a Loan Debt outstanding of only some £35,000, including the amount borrowed for the present extensions. That was a very satisfactory state of affairs, especially as provision had been made to repay this loan debt within the next fifteen or sixteen years, which repayment would be possible largely as a result of the savings which would be effected by the installation of vertical retorts. And the Commissioners were looking forward to a steady reduction in the price of gas during the next few years.

In conclusion, Mr. Sharp conveyed, on behalf of the Gas Commissioners, to Mr. Cuthbert, their Engineer and Manager, their appreciation of his valuable services, not only since he took up his present position in Grangemouth, but particularly during the recent extensions of their works. He also congratulated the Contractors on the very able and expeditious manner in which they had carried out the work.

Advantages of Gas.

Judge Gloag gave the toast of "The Gas Industry," and said that at a gathering like this, marking as it did the further progress of gas manufacture in Grangemouth, it was proper that they should recognize something of the debt they owed to the Gas Industry. From the time when gas was first introduced on a commercial scale it had played a prominent part as a distributing medium for light and heat and power. It was apt to be assumed in some quarters that the Gas Industry had passed its zenith, and that gas was an old and, therefore, a decaying Industry. Of course, there was no justification for associating age with decay in industry—the age of an industry and its vitality were in no way interdependent. He would be the last to belittle the great value of electricity as a powerful public servant which was destined to achieve still greater things in the future. They all realized what it had meant for mankind in the telephone and the telegraph, in its application to medical science, and in other fields of human activity. At the same time, gas had many advantages which were not possessed by electricity. It could be regulated as to the measure of heat to be given in a cooker or fire more easily and more cheaply than electricity. Gas fires, just because they had to be ventilated in the same way as coal fires, ventilated the rooms in which they were used—a most important consideration from the point of view of health.

To-day the Gas Industry actually seemed to have taken on a new lease of life, and with the improvements in the technical methods of production by means of more up-to-date plant, it seemed as if gas was again coming into its own, in spite of all the handicaps from which it had suffered in the past.

In these days anything that smacked of labour-saving carried a strong appeal. Politicians, social workers, novelists, and journalists painted for them rosy pictures of a future when all houses would be so well equipped with labour-saving devices that they would just sit around, pressing the buttons while Robots did everything for them. But these things were always in the future, in a Utopia which they never seemed to reach. What the modern, practical young housewife wanted was not the ideal house of the future, but the home for to-day—a house fitted now with clean, economical, labour-saving equipment; hot water at every basin; gas fires that made no dust and left no ashes to be cleared

PHOTOGRAPHED OUTSIDE THE RETORT HOUSE AT GRANGEMOUTH.

away; hot baths whenever they were required without any preliminary work; gas cookers and even gas-operated refrigerators—and these were some of the boons and blessings offered to-day by the Gas Industry to equip the well-planned house.

Mr. H. G. RITCHIE, as President of the North British Association of Gas Managers, responded to the toast, and congratulated the Town Council and their very capable Engineer, Mr. Cuthbert, on their possession of the up-to-date works which they had just inspected. He saw the works not long after Mr. Cuthbert took charge, but on that occasion he had to offer sympathy instead of congratulations. He could assure the Grangemouth Town Council that Mr. Cuthbert had proved himself such a man as the Gas Industry was proud to have in its ranks.

THE DUNDEE SALARY.

That raised a point to which he would like to refer—the salary of £825 per annum which was being offered by the Dundee Corporation for a Gas Engineer and Manager. Such remuneration was poor encouragement indeed for young men of good education to enter the Gas Industry. The Dundee Corporation said they desired a man who was a Member or Associate Member of the Institution of Gas Engineers; the considered view of that Institution, based upon its experience and the information and statistics which it possessed, was that the salary should be £1250; and when it was considered that the man appointed would be in charge of an undertaking with a revenue of £340,000 per annum, having a capital value of £1,200,000, and be responsible for the erection of all new works, he thought they would agree with the view of the Institution.

Judge GLOAG had referred to the boosting of electricity by politicians, social workers, and others. In his (Mr. Ritchie's) opinion the Gas Industry had been at fault in not advertising itself sufficiently in the past, and it was up to every gas undertaking to support the activities of the Gas Industry now, especially the British Commercial Gas Association and the Institution of Gas Engineers—not to be content merely to subscribe, but to support these bodies by being represented at their conferences.

NOTES ON NEW BOOKS

PROGRESS OF APPLIED CHEMISTRY.*

Those who wish to keep in touch with the progress of applied chemistry cannot afford to miss perusal of the reports of the Society of Chemical Industry; and the volume covering the year 1930 is now available. There is no change in the make-up of the book, which is well-known to our readers, though there is a customary change in the authors of the various sections. From the Gas Industry's point of view, the importance of the publication lies in the five sections General, Plant, and Machinery; Fuel; Gas, Carbonization, Tar, and Tar Products; Acids, Alkalis, and Salts; and Refractories.

The first-mentioned section is written by Mr. R. Edgeworth-Johnstone, who states that two chief trends are noticeable in the evolution of instruments for use in chemical works—on the one hand, simple indicating devices tend to become elaborated so as to yield continuous records; and on the other, methods of measurement which were at one time confined to the laboratory of the physicist are pressed into service and adapted for use under industrial conditions. Examples of the first tendency are found in two new instruments described by M. Duchène for recording variations in fluid flow in conjunction with an orifice plate. The first is a steam meter and the other a recording apparatus for gas flow; and both these have been mentioned in the "JOURNAL" (Vol. 191, p. 309). A new type of rotameter has recently been introduced which enables this form of flowmeter to be inserted in a horizontal pipeline; and a new liquid level gauge, claimed to be extremely accurate, has been devised for measuring liquids stored in bulk. The instrument employs a weighing beam for measuring directly the pressure head of liquid in a tank. A radiation pyrometer has been patented in which light is reflected from the hot body through a filter on to a selenium bridge or other sensitive device; while a method is described for determining gas temperatures which is based on the fact that when a gas is passed through an orifice at a definite speed, the pressure difference is approximately proportional to the absolute temperature. Reference is made to the gas interferometer, which has been found useful in process control, being calibrated according to the gaseous mixture to be observed. For instance, it is easy by this means to determine the benzole content of coke oven gas either before or after scrubbing, and the method compares favourably with that of adsorption by active carbon as regards speed and reliability.

The section on fuel, which includes a highly valuable bibliography, is by Mr. H. J. Hodsman and Dr. A. Key, of the Leeds University Fuel Department, and in the course of it they remark that the use of surplus gas from coke ovens would certainly help the coke oven industry and contribute to the national economy of fuel and the elimination of smoke. Any large extension of its use, they state, can only be made at the expense of the use of solid fuels—indeed, this is obviously contemplated as is indicated by the suggested selling price of less than 2d. per therm. Coke oven gas will generally displace at least its own equivalent of coal—a national economy, but involving a further restriction of the markets of the mining industry. The immediate benefit to the coal mining industry is thus obscure, although ultimately it should benefit by increased industrial prosperity. "It is sometimes suggested that the coke oven gas distributed must be backed by stand-by plant at the gas-works. This may be necessary so far as concerns domestic fuel, but in times of emergency, can industry reasonably expect to have a guaranteed fuel supply? It does not have it now, nor does it get a guaranteed supply of water and electricity. Obviously such differentiation in the character of service also needs freedom to vary the prices and conditions of supply. For instance, for many industrial purposes the gas need not be purified."

On the question of smoke abatement, the same authors observe that metallurgical furnaces have secured certain exemption from the application of smoke abatement acts because it was held that a smoky flame was essential in the heat treatment of steels. W. H. Blackburn and J. W. Cobb have found, however, that the anti-scaling effect of carbon deposited from hydrocarbons was negligible and concluded that no agent available in practice is better in this respect than the clean reducing flame obtainable from such a fuel, rich in carbon and poor in hydrogen, as a dry coke.

The section on Gas, Carbonization, Tar, and Tar Products is by Messrs. J. Macleod and T. A. Wilson, who refer to several interesting patents relating to carbonization which have been taken out recently. One novel suggestion, which has been noticed in the "JOURNAL" Register of Patents, is the provision of movable outer walls permitting the varying of the width of the carbonizing chamber. Another is an inclined retort into which the material is carried on a scraper conveyor, the retort being divided into sections of different temperatures by the material itself piling up on the conveyor as it enters sections of decreasing height. Then, to provide dual capacity retorts suitable at one time for low-temperature carbonization, at another for high-temperature operation, a special baseplate may be fitted to a high-temperature retort, and this then acts as a support for a removable metal low-temperature retort, which can be readily converted to high-temperature working by removing the conductors and seatings. On the subject of ammonia, the authors remark that the small margin of profit available—if any exists at all—from the production of ammonium sulphate compels attention to any possible outlets for the ammonia present in ammoniacal liquor. Many patents have been obtained for the preparation of mixed phosphates, which should find a ready market as concentrated fertilizers.

Messrs. P. Parrish and F. C. Snelling write about Acids, Alkalis, and Salts, and stress the need for new uses for ammonia. "It is believed that with the decreasing price of bye-product and synthetic ammonia, new uses will be found. Indeed, evidence is already available of the various miscellaneous new uses to which ammonia can be applied. In this connection, mention may be made of chloroamine for the purification of water, the use of ammonia as a substitute for lime in the manufacture of sulphite pulp, and its employment as an accelerator in rubber vulcanizing. As an alkali ammonia is cheaper than caustic soda per unit of neutralizing power, and certainly ought to be used to a much greater extent in the cotton and woollen industries than hitherto."

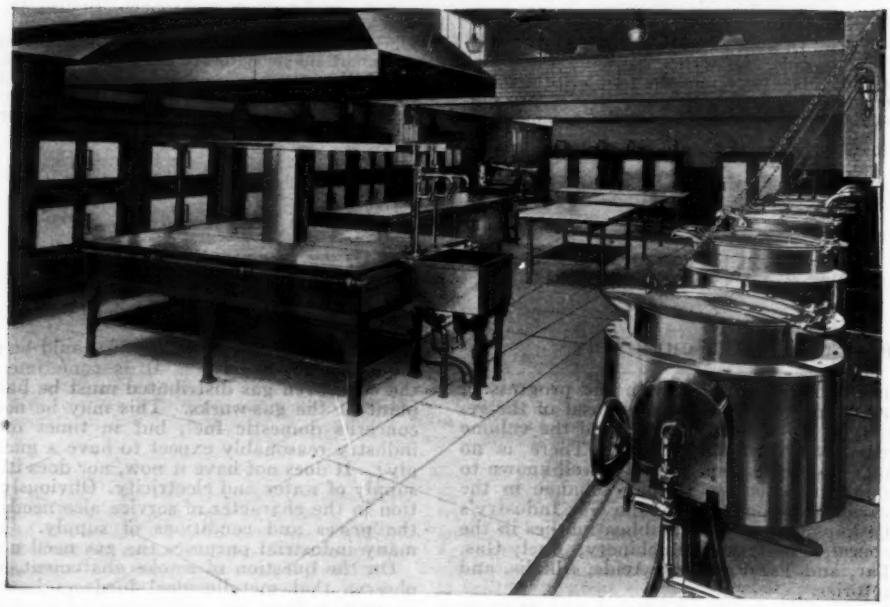
The section on Refractories, by Messrs. J. H. Chesters and W. J. Rees, has but little reference to the Gas Industry, and even in a general survey such as this, one is surprised to find no mention of the work of A. T. Green.

* Annual Reports of the Society of Chemical Industry on the Progress of Applied Chemistry, 1930—Vol. XV. Price 7s. 6d. to members, and 12s. 6d. to non-members.

- - MODEL STAFF - -

RESTAURANT KITCHEN

Gas Cooking Equipment at Harrods' Stores

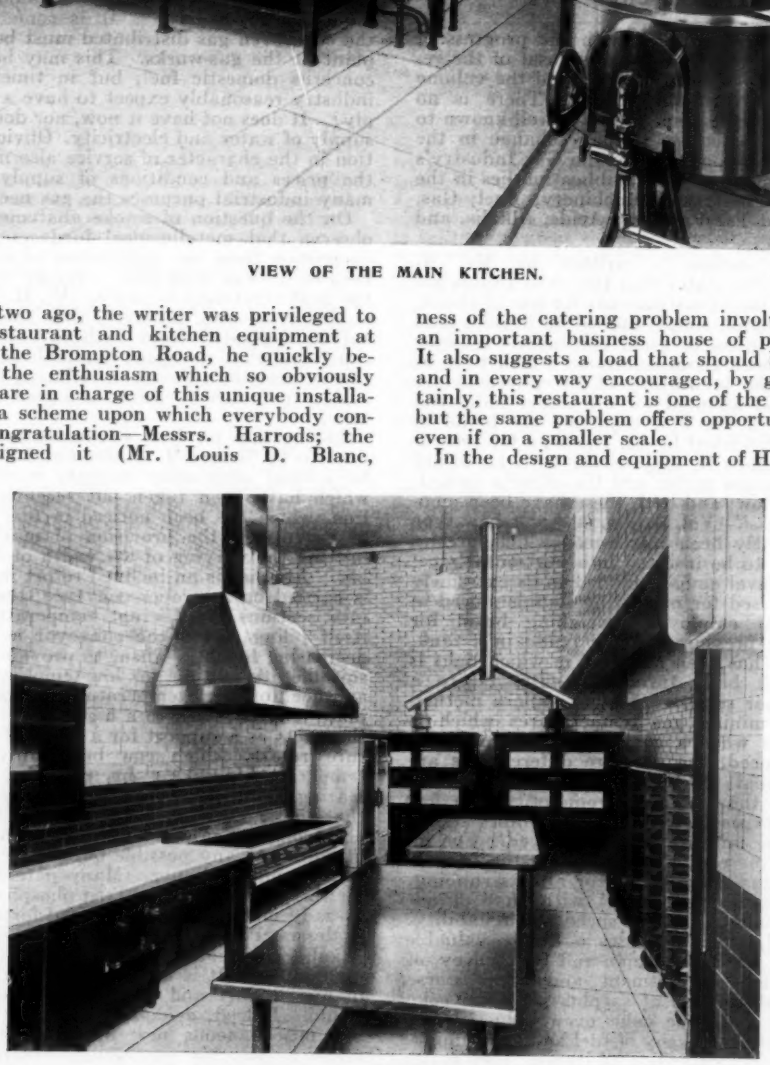


VIEW OF THE MAIN KITCHEN.

When, a week or two ago, the writer was privileged to inspect the staff restaurant and kitchen equipment at Harrods' Stores, in the Brompton Road, he quickly became imbued with the enthusiasm which so obviously animates those who are in charge of this unique installation. It is, indeed, a scheme upon which everybody concerned deserves congratulation—Messrs. Harrods; the Architect who designed it (Mr. Louis D. Blanc, L.R.I.B.A.); the firm who carried out the complete installation (Messrs. Benham & Sons, Ltd., of 66, Wigmore Street, London, W.); those who are in charge, and those who have to work in it; and, last, but not least, the thousands of members of the staff for whose benefit it is provided.

Reference to "thousands of members of the staff," which is literally correct, suggests to the mind the bigness of the catering problem involved in connection with an important business house of present-day dimensions. It also suggests a load that should be energetically wooed, and in every way encouraged, by gas undertakings. Certainly, this restaurant is one of the largest in the country, but the same problem offers opportunities in all directions, even if on a smaller scale.

In the design and equipment of Harrods' staff restaurant and kitchen, efficiency, hygiene, and comfort have all through been kept in mind; and the same remark applies to the quality of the apparatus and fitments—in every instance the best has been employed. No less than 3000 sq. ft. of stainless steel is utilized, while all other metal surfaces are either coated with mottled enamel or are chromium plated. The approximate duty required of the installation is to cook for 4000 members of the staff in four



THE PASTRY KITCHEN AT HARRODS' STAFF RESTAURANT.

sittings, the service being on cafeteria lines. The capacity of the cooking apparatus will, however, allow for the greater numbers involved during the busy seasons.

Seven Double-Deck Gas Roasting Ovens.

Gas and steam are used for cooking, both in the Main Kitchen and the Pastry Kitchen, which are shown in the accompanying illustrations. In the Main Kitchen, the meat is cooked in seven double-deck gas roasting ovens, which are externally heated. After this it is carved by a slicing machine and kept warm in stainless steel hot cupboards, or passed out to the service ready for consumption. There are also in the Main Kitchen two double gas grills and a four-pan fish-frying range. With regard to this fish-frying range, which is a combination of mottled enamel finish and stainless steel, it may be added that each pan measures 30 in. by 24 in. by 12 in. deep. So efficient is the ventilating system that no smell of cooking is noticeable in the kitchen or adjoining rooms. In the background of the photograph of the Pastry Kitchen will be noted two externally heated double-deck gas pastry ovens, while on the left are a stainless steel steam proving oven and a large gas hot-plate. The output of these ovens varies from 2000 to 3000 cakes or portions per day.

The Service Counter.

A feature of the installation is the cafeteria service counter, 157 ft. in length. The hot portion is 48 ft. long, and this, together with the top of the whole counter and all the shelves, is constructed of stainless steel, which metal is also used for the back counter. There is ample provision of gas salamanders, milk and coffee urns, &c.; the total capacity of the urns connected with the service being 100 gallons. Tea is made as required, and between 5000 and 8000 cups of tea and coffee are served out daily. So complete, and so well thought out are the arrangements, that it is estimated that every diner should be seated at his or her table, with food, within three minutes of arrival in the restaurant. Two "Victor" dish-washing machines with automatic feeding are installed, each having a capacity of 12,000 pieces per hour.

A Restaurant in Keeping.

Everything, of course, is spotlessly clean, and one notes the coolness and freshness of the atmosphere. The restaurant is, in fact, fully in keeping with the reputation for good quality and good service which has always been enjoyed by Harrods' Stores.

Distribution Conference of the A.G.A. - - -

An Esteemed Correspondent contributes the following notes

I have just returned from the eighth annual distribution conference of the American Gas Association, held in Cincinnati, April 8, 9, and 10. In recent years, various subdivisions of the Gas Industry have formed the habit of meeting separately once a year in addition to the yearly convention of the entire Association. So we have production, distribution, accounting, and sales conferences, and to date there seems to be no faltering in the belief that these special gatherings are of great value. My reading of the "JOURNAL" would indicate that the same conditions exist in Great Britain.

In all, there were fifteen hours of session time, in which twenty-five reports and papers were considered. Interest was well maintained throughout, and at each session a large part of the three hundred delegates were on hand. As seems to be usually the case in these meetings of ours, the programme was too extensive for the session time and discussion was unduly shortened. Copies of all the papers were distributed at the beginning of each session, and if every author had been wise enough to abstract his presentation, the resulting advantage to the meeting, through increased discussion time, would have been much greater.

The topics of the conference were centred around the outside distribution system, street mains, and services. This subject has recently increased in importance because of the growing availability of natural gas under high pressure to large sections of our country. To mention but one of many instances, Chicago is preparing to receive natural gas in a few months, and the upwards of fifty million dollars being spent on the nine hundred miles of 24-in. supply line indicates the extent of these changes. The natural gas will be mixed with manufactured gas, and the mixed gas will differ sufficiently from the present supply to require a change in the adjustment of several million appliances.

This possibility of mixing natural gas in varying percentages and with various forms of manufactured gas, is making us appreciate the advantage of selling by the therm instead of by the cubic foot, and thus we are preparing to follow where you led. Because of the 1100 B.Th.U. available in the natural product, it is probable that in many cases the most economical heating value will be from 700 to 800, to the manifest reduction of distribution, commercial, and general expense costs per therm.

Increased Pressures.

The advent of natural gas into city areas is resulting in increased distribution pressures. In Los Angeles, 150 lbs. is carried in the high-pressure lines, and 7 in. in the low-pressure network. Other cities are slowly changing from 3 and 4 in. to 5 and 6 in. This tendency to greater pressures has given impetus to the pipe joint research now in progress at the A.G.A. laboratory, and one session was devoted to this and related pipe subjects.

Another session was occupied with a second factor in the tightness of a distribution system—viz., the corrosion of steel pipe and the effect of preventive coatings. The soil corrosion studies and the pipe coating research as conducted by the Bureau of Standards were well presented, and in the coming years valuable information should be forthcoming.

The increased volume of gas output arising from the supply of cheaper gas has also necessitated laying more feeder main and a general overhauling of the distribution systems. This has focussed attention on the design of these systems, and during one session, lasting from 8 till 11 p.m., four papers described the particular features of the mains in Los Angeles, Denver, Cincinnati, and Chicago. Much divergence of opinion was disclosed, and only lack of time prevented a lively and informative discussion. Denver is still devoted to 2-in. pipe, as adequate for most of the low-pressure systems, and is ready to defend this thesis against all comers. At this evening session, the audience was held to the very end, showing that everyone was intent on business, and this note ran through the entire proceedings.

To one who has been attending gas meetings for thirty-six years, there is something very inspiring in the sight of so many young and earnest workers, prepared to advance all along the line and to demonstrate the progressive spirit of the Gas Industry, a spirit equally in evidence on your side of the Atlantic.

THE "JOURNAL" TECHNICAL RECORD

Which contains Full Reports of Meetings of Gas and Allied Associations

The Domestic Smoke Problem

By ARNOLD MARSH, M.Sc.Tech.

[From a Paper before the Institute of Fuel]

The encouragement of smokeless domestic heating by legislative methods is still a thing of the future, and there is no immediate possibility of such an advance becoming practical politics. The reduction of smoke from this source can, at present, only be proceeded with along two paths. In the first place, by supplying smokeless media that will satisfy all the requirements of the home at a cost, in the majority of cases, not greater than that of using coal; and secondly, by bringing the facts of the smoke evil before the people so persistently that a strong public opinion may grow against smoke, so that it will be considered to be socially wrong for smoke to be emitted, just as to-day the disposal of kitchen refuse by throwing it into the road is unthinkable by any respectable household.

The use of smokeless media is, of course, already considerable, and in many directions their popularity is rapidly growing; nevertheless, at the present rate of progress a long time will elapse before domestic smoke can be disregarded. The quantity of raw coal used per house for domestic purposes is much lower than it was a generation ago, but, because of the great increase in the number of dwellings, there is actually little change in the total amount of coal consumed for this purpose.

The smoke emission from new coal-burning houses is probably much lower than that from older ones, owing to the use of more modern ranges and types of open fires which consume smaller amounts of fuel, and which are far more efficient than the older types. At the same time these exceedingly extravagant old-fashioned appliances are still being used in many new dwellings, and, of course, continue to do service in countless numbers of older houses.

The questions which arise in considering this problem may be roughly grouped under three heads, as follows:

1. The equipment of new houses and those where alterations can be afforded, with the best smokeless methods of warming, water heating, and cooking.

2. The supply of smokeless solid fuels for existing houses where alterations are not possible which will be as efficient and as convenient as the displaced raw coal, and, for a vast number of cases, will be actually cheaper than coal *on first costs.*

3. The extension of smokeless methods of local warming in all houses, which, in addition to methods which are scientifically more preferable, must include the provision of satisfactory solid fuels which will displace the use of coal in the open fire, and yet which will retain the important qualities which are the chief virtues of such fires.

The media available for these various purposes include the natural smokeless coals, mainly anthracite and the steam coals; carbonized coals, including gas coke, oven coke, and low-temperature coke; electricity and gas; fuel oil and kerosene (paraffin). Each of these may be used in some way in one or more of the three main requirements of a normal house—cooking, water heating, and warming, either locally, centrally, or in combination. Two other auxiliary factors have also to be considered—namely, the ventilation of rooms and the disposal of refuse. It is therefore obvious that anything like a full discussion of the numerous methods and permutations of methods which are available is impossible, even if it were desirable, within the limits of this paper.

GAS AND ELECTRICITY.

At the present time the greatest interest is concentrated on the solid fuels and the various problems associated with their successful production and use. Gas and electricity, though not so amenable to discussion in this paper, are nevertheless of the greatest importance, and together are responsible for the greater part of what domestic smoke abatement has already been achieved. In each case a highly efficient supply service is ably backed by continually improving appliances, especially cookers and fires. The new types of thermal storage water heaters, for use with either medium, for example, are an excellent development for the economical and efficient supply of domestic hot water, and in many other ways are those who have these media available being shown the possibilities that they possess.

The freeing of the Gas Industry from the antiquated shackles which still hamper it, and the consequent increase in the value of the service that can be rendered as a result, will be welcomed by all interested in smoke abatement, as will the completion of the national electricity scheme, as a result of which it is hoped that there will be a substantial decrease in the cost of electrical energy. While in many districts the cost is already at a figure which makes its general use possible for the average household, there are others in which the charges are prohibitive except for very restricted use.

THE PROBLEM OF THE OPEN FIRE.

The use of electricity and gas is destined to increase considerably, but, apart from the question of cost, these media alone cannot achieve a complete abatement of domestic smoke. The demand of the British public for the open fire is as strong as ever, and there is no possibility, in general, of this demand disappearing. The problem is of great interest. Why, it may be asked, should there be such a strong prejudice in favour of the open fire in this country, to an extent probably greater than in any other land?

There is possibly some definite radiation or other quality in the type of fire of which that using bituminous coal in an open grate is the most widely known, which has some actual physiological action upon the body, or, on the other hand, the main factor may be purely psychological. The latter is perfectly understandable when it is remembered what a large part is played by fire, the source of heat and comfort, in the lives of a people dwelling in a climate which necessitates artificial warmth during the greater part of the year, and which, in addition, is subject to frequent rainy and lengthy damp periods. Many thousands of dark and cold winters have been rendered tolerable to our ancestors only because of the indescribable joy of fire, with its glowing embers and leaping flames; and it is only natural that we, in spite of our more sheltered conditions, should have inherited, from such sharp and pleasurable experiences a similar complete and ineffaceable delight in, and prejudice towards, the open fire.

The open fire also provides an excellent and healthy method of ventilation, a factor which must be carefully considered in living and other rooms occupied for long periods, and, further, provides a rapid and sanitary method for disposing of household refuse. It will, perhaps, not be out of place to mention the real value of the open fire to the pipe smoker; and even the nervous recipient of amatory correspondence might claim consideration.

In spite of these advantages the open fire stands condemned for its inefficiency, and for its quite unavoidable smoke production. The solution of the problem is dual—to restrict the open fire to those uses where its peculiar advantages make it desirable—popularly expressed, to fires used for sitting in front of—and to use in them smokeless solid fuels which will answer all the purposes of soft coal.

SOLID FUELS.

Much interest is concentrated to-day on the possibilities of the various types of smokeless solid fuel. Graded steam coals, anthracite, gas and oven coke, and low-temperature semi-coke are the available materials, and in these there is everything needed to supplement electricity and gas in the total abolition of domestic smoke. The fuels fall into two different categories—those which can replace soft coal with certain success in every type of grate, kitchen range, or

stove, and those which need special or adapted appliances to obtain the best results. In the latter class there is already a wide and growing use of the natural hard coals and of high-temperature cokes, in domestic boilers, central heating plants, and in the excellent new types of specially designed open fires, many of which are fitted with gas burners for ignition purposes. Probably the cheapest way of obtaining, with one fire, hot water, limited central heating, and cooking requirements, is with the well-known combined range using any kind of suitably graded coke or anthracite.

The final point to be considered is of extreme importance —that of the supply of a smokeless fuel which will equal coal in every respect, and which must be sold at a similar competitive price. One of the most important aspects of this domestic smoke abatement problem is that of making smokeless the innumerable small houses of every town and city, including the actual slums, where the price of gas and electricity is either wholly or partially prohibitive, and where there are no chances, except under some subsidy arrangement, of altering existing fireplaces and ranges to permit the use of such fuels as anthracite and hard cokes. Such areas of small houses and tenements are generally huddled together over a large area, and their combined chimneys, each in itself almost negligible, create a vast and concentrated pall of high tar-content smoke. Our large towns will never be smokeless until these houses can be supplied with a suitable fuel, at a price no higher than that of low-grade household coal, and which can be obtained easily and in small quantities at a time. It must be stressed that in these homes, and, indeed, in the majority of middle-class homes as well, the true cost for heat obtainable will not be considered to any appreciable extent, or at any rate only as a secondary factor. Even though it is scientifically erroneous, the deciding factor, above all others, will be the *price per hundredweight*.

The fuels which can render this possible are low-temperature and certain classes of high-temperature cokes. The production of low-temperature fuel for domestic purposes is, of course, only one aspect of the complete technical and commercial success of this method of carbonization, and must depend very largely upon the profitable disposal of the other products and upon the economic stability of the process or processes as a whole. From the smoke abatement point of view, however, the price and quality of the solid fuel are the deciding factors of its success. The price, up to now, is low enough to obtain a limited, even though still unsaturated, market, but it is still far from being competitive with the cheaper grades of coal.

With respect to quality and general performance in the open grate, low-temperature cokes have been, and are being, produced which are in every way excellent and leave little to be desired. Two practical points of importance, which apply also to other cokes, may be mentioned, as apparently they have not been considered to the necessary extent by those concerned. The ash in a carbonized coal is more flocculent and bulky than that derived from an untreated coal, and, apart from the ease with which it will fly about the room (a further point requiring examination) appears to be greater in quantity than it actually is. Thus, to the housewife, a carbonized fuel containing (say) 10 p.ct. of ash will appear to be "dirtier," as she will express it, than a coal containing a like amount. There is no doubt that many people using such fuels for the first time have been permanently prejudiced against them because of what they have considered to be an excessive quantity of ash. The remedy is to supply fuels which actually have an ash content as far below that of the average household coal as is practicable. Only by such means will the fastidious user be satisfied. The second point is that carbonized fuels, probably owing to their cellular structure, absorb and retain moisture in a way that raw coal does not. The fuel is then unpleasant to handle, difficult to ignite, and burns dully. Here, again, the delivery of such a fuel is likely to create prejudice against it, especially when it is being tried for the first time, which, if its use is to increase, must be so in a large number of cases. Shelter during transport and storage, although perhaps troublesome, seems, therefore, to be necessary.

With respect to gas coke there is much requiring to be done. Nearly all grades of such fuel have greatly improved upon that produced some years ago, and that of many gas undertakings, especially from vertical retorts, is consistently excellent for household purposes, being clean, dry, low in ash, and high in calorific value and radiant efficiency. Such high-quality coke can be burned successfully in many ordinary open fires, in addition to those specially designed for its use, but it is not unfailingly successful. But by the blending of suitable coals, and, if necessary, by controlling the distillation so that the coke retains a slightly higher percentage of volatile matter, a high-temperature coke can be produced which is equal, or nearly equal, to the best low-temperature fuels. That is, it will ignite without difficulty, give a cheerful and lasting fire, and remain burning in even a low fire. Such cokes can be sold at low prices, and can be properly distributed through the organization which every gas undertaking has. However, with a few notable and commendable exceptions, little has been done in this direction, for the Gas Industry, on the whole, looks upon the product which contains 45 p.ct. of the thermal value of the coal it uses as of little importance. The Industry has done much for smoke abatement in one direction, and there is here the opportunity for it, in another direction, to do much more.

Oil.

Mention should be made of the importance of oil as a fuel assisting smoke abatement. Apart from its industrial uses for power production, it is of considerable value in the central heating of larger houses and city buildings. The convenience of storage, automatic and thermostatically regulated feed, entailing the minimum of attendance, makes this fuel, in many cases, very suitable for the heating of buildings. The oil stove is a useful appliance for auxiliary local heating, and the modern oil cooker is an excellent product.

This brief survey of the domestic question shows that all available methods have their value and have their own part to play in abating the nuisance. The cheapening of gas and electricity, and extended use of solid fuels for use in the special grates, and the supply of a low-priced good quality fuel, competitive with coal in every respect, and capable of being burned in every grate or range, are the outstanding needs. Beyond these things, and required by them for their rapid development, is the necessity for making the public realize that smoke is a thing which is in every way evil, costly, and stupid; that it is largely occasioned by them; that it should be a recognized civic obligation not to produce smoke; and that smokeless methods will pay them in every possible sense.

It will have been seen that a considerable diminution of the smoke nuisance is possible at once, and that still further progress will be achieved when efficiency and fuel economy take their proper place in every industrial establishment, and when the domestic demand can be satisfied more completely by the several smokeless mediums which are, in varying degrees, already available. There has been a fair amount of progress during the last quarter of a century, and an appreciable improvement has been effected, but the rate must be greatly accelerated before the efforts which are being made can be slackened. Indeed, the most urgent need at the present time is for those efforts to be increased and made much more effective than they have been in the past. One of the greatest stumbling blocks of all has not yet been mentioned, and this is the apathy of nearly everyone to what is undeniably a grave problem. This inexplicable indifference must be overcome, and the pressing need is for education, publicity, and propaganda of every possible kind. The facts are there, but they are not known. They must be brought persistently and clearly before the public and the manufacturers; before Parliament, every municipal council, and every health committee. Only by such means will the nation be brought to realize the desirability of abolishing smoke, and until this happens, and the realization is followed, as it would be, by a demand for, and accomplishment of, reform, abatement will continue to be imperceptibly slow, and a complete cleansing of the skies nothing but a vain and unfeasible aspiration.

Discussion.

Mr. H. Clifford Armstrong, who is a fuel technologist connected with the iron and steel industry, defended the manufacturers. Fuel technologists, he said, were engaged by all the big firms, and the engineers of the smaller firms were equally interested. The difficulties of the manufacturers in competing with the foreigner were so great that every penny they could save in fuel was of immense importance to them, and they realized that saving in fuel, if not the only channel, was the most promising channel through which to effect economy. The duty of the fuel technologists was to prevent smoke, because by doing so they could economize in fuel, but they were also interested in smoke abatement from the social point of view. At the same time, it was utterly impossible to carry out many of the processes in the industry with existing furnaces without emitting a certain amount of black smoke; and if the law were altered and the manufacturers were not given another two or three years in which to continue their experiments before the enforcement of more strict laws, the result might be to close down the steel industry. He calculated roughly that it would cost about 30s. per ton of coal burned per year to convert the furnaces for the use of smokeless fuel; even were that smokeless fuel economic. The group of manufacturers with whom he was associated were burning about a quarter of a million tons of coal per annum, and that indicated the amount of capital that would be required to convert the furnaces.

Mr. John Roberts commented upon the courage which Mr. Marsh had displayed in presenting his paper to the Institute of Fuel. Every honest effort to reduce smoke and the evils re-

sulting from smoke emission deserved commendation. He expressed surprise, however, that Mr. Marsh should have included, in a paper dealing with the smoke problem, a reference to the indescribable joy of fire, and the statement that our inheritance from our ancestors of a complete and ineffaceable delight in, and prejudice towards, the open fire (presumably raw coal fire) was natural. If that were intended as a boost for the use of raw coal, said Mr. Roberts, he could have understood it. He would have preferred that Mr. Marsh had spoken of the joys of an open fire which would be absolutely smokeless rather than an open bituminous coal fire.

Mr. E. W. L. NICOL said that, if Mr. Marsh's paper had proved anything, it had proved that the only means of eliminating smoke was to use smokeless fuels. Mr. Marsh had shown that the only smokeless fuels generally available in this country were gas, gas coke and oven coke, anthracite, and, to some extent, the anthracitic coals. It was unfortunate that so much of our coke should have to find a market abroad, while we imported very large quantities of fuel of foreign origin which was neither smokeless nor free from volatile sulphur. The imports of oil last year had increased by 20 p.ct. to 420 million gallons; that quantity was imported duty-free, while some 500,000 of the men and women in the coal trade of this country were on the dole.

Mr. W. D. CAROE (an Architect) emphasized that the smoke nuisance did not occur so much in other countries as in Great Britain. In this connection he referred to the cleanliness of the air at Barcelona, a city of about a million inhabitants, in which central heating was used largely, and where there was a large consumption of gas for heating. The better conditions on the Continent were due to the use of smokeless fuels, and he felt convinced that that would be the solution of the problem in this country.

Mr. MARSH, replying to Mr. Roberts' remarks, said he did not think it could be denied that the open fire had certain attractions, but quite an attractive smokeless open fire could be obtained. Indeed, he knew people who had become accustomed to the smokeless fuel fire, with its different type of radiation, and had come to prefer that type of fire to the ordinary coal fire. It was a change of habit which could be brought about, to the advantage of smoke abatement.

Working of Glover-West Retorts and Plant

By H. G. BROADBRIDGE, of Leamington Spa.

[From a Paper before the Midland Junior Gas Association on April 16]

The members of this Association have already had put before them the construction of various types of vertical retorts and their normal working; therefore I intend to tell you of various minor difficulties, some of them of a purely local character, and the means adopted for overcoming them.

DESCRIPTION OF PLANT.

The installation of Glover-West vertical retorts at Leamington, which was put to work in November, 1928, consists of a bench of four settings arranged in units of fours and settings of eights, making a total of thirty-two 40-in. New Model retorts. One producer is provided for each setting. The retort house building is of the steel-framed brick-panelled design, the steel framing being bricked in on the outside.

The coke extractor gear mechanism is actuated by two electric motors, each capable of driving the complete system, so that one acts as a stand-by to the other.

The coal handling plant consists of a receiving hopper of 5 tons capacity, from which the coal is fed into the mouth of a 40-ton per hour single-roll breaker and so into a 40-ton per hour bucket elevator which discharges the coal into a West lip-bucket conveyor capable of dealing with 40 tons of broken coal per hour. This conveys the coal into the storage bunkers which are large enough to hold 48 hours' supply of coal, somewhere in the region of 400 tons. The lip bucket conveyor encircles the retort bench and is so designed that it receives the discharge of coke from the bottom mouthpieces and conveys it into the storage hoppers. The latter have a capacity of about 160 tons, and are placed at the coal plant end of the retort house.

A 20-cwt. semi-automatic push-button type electric lift is installed to give access to the producer charging platform, and the stack platform, and at the level at the top of the coal bunkers this platform is fitted with rails and a turntable, to act as an auxiliary means of raising coal to the bunkers in the event of a breakdown to the lip bucket conveyor.

The coke extractor gear mechanism and the coal and coke handling plants are actuated by electric motors. The electric generating plant consists of a vertical steam engine coupled to a 35-KW. generator. As a stand-by we have two old gas-engine driven generating sets which were used in connection with our previous horizontal retort house.

A Spencer-Bonecourt waste-heat boiler is fitted to the plant at the stack platform level and supplies steam to the turbine for driving the "Sirocco" fan for the induced draught to the settings, to the retorts, and to the generating set, any surplus passing to the yard mains. When three settings are at work there is sufficient steam for the generating set to supply the electric motors in the yard, which are connected with a telpher track, an oxide disintegrator, and a small rotary coke screen; but when only two settings are at work one of the stand-by gas engine driven sets has to be used.

TROUBLE WITH COKE DUST.

The Gas-Works at Leamington are completely surrounded by houses, and the vertical retort house was built slightly nearer one of the streets than the previous horizontal house was, this being the only site available.

The plant had not been in operation long before a complaint about coke dust was received from the inhabitants of some of these houses. There was no question of this, as we have seen it in the rooms of the houses and on a fishmonger's stone slab some 40 yards from the retort house. Various methods were tried to prevent this nuisance, such as Cortin sprays of different sizes placed over the bottom mouthpiece doors, allowing a fine spray of water to fall on the coke during the discharge. This was not very successful, as much of the finer dust got away into the atmosphere. Another experiment we tried was with an air suction plant. In the sides of the movable coke chute, for allowing the coke to fall from the mouthpieces into the lip-bucket conveyor, holes were cut, and small bar screens were fitted into the openings. The backs of these screens were connected into a common duct, and so to a small fan; and for our experiments we allowed it to discharge to the atmosphere. It was our intention to allow the dust to pass forward into a collector.

While we were carrying out this experiment we decided, more or less as a temporary measure, to fit a $\frac{3}{4}$-in. water supply outside and just above the doors of the bottom mouthpieces. The supply to each mouthpiece was controlled by a separate tap, and the supply was drilled with $\frac{1}{8}$-in. holes the whole width of the mouthpiece. At every discharge the water was turned on, and it was found that this made a curtain of water through which the coke had to pass on its way to the lip-bucket conveyor. This idea proved so satisfactory that we did not carry on with the air suction method, and we are still using the sprays.

Our coke hoppers are situated outside the retort house and no covering was placed over them. We found that a large quantity of dust was liberated at the screens in the hoppers, so an asbestos cement sheet building was erected over these, to keep the dust inside. Water sprays have been connected at all the outlet chutes from the hoppers, and care is taken that all coke, when being moved, is well sprayed. Complaints about dust have now ceased, but the disadvantage of the water sprays is that the water clogs the screens, and these have to be cleaned out frequently.

COKE SCREENS.

The coke is tipped from the lip-bucket conveyor on to a screen with horizontal bars placed at about $3\frac{1}{2}$-in. intervals, and the coke which passes over this screen is allowed to fall into the large-coke compartment. That which goes through falls on to a similar screen with the bars at 2-in. intervals. The coke which passes over goes into the small-coke compartment, and that which goes through into the breeze compartment. In the cart loading outlets of the hoppers small bar screens are fitted which take out the greater part of the coke dust still present. With this simple method we get reasonably good screening, the coke being carted directly away to the town or to the railway sidings. Any surplus coke is let out of the large-coke compartment into a telpher skip and taken to the storage ground. The breeze is carted to the telpher and taken to

a small rotary screen where the breeze and dust are separated. The breeze is afterwards washed.

Noise from the Waste-Heat Boiler Plant.

When this plant was first started the discharge from the fan made a roaring noise which caused some annoyance to neighbours. The shape of the discharge cone was very similar to an old horn loud speaker with the size of the opening 5 ft. by 3 ft. 6 in. We shut the waste-heat boiler down for a short period in order to hang a swinging plate in the mouth of the discharge to try to split up the gases. In starting up again we had trouble in turning the turbine, and found on examination that the " Sirocco " fan was jammed to the side of the casing with an oily carbon deposit. This was removed and the boiler put to work again. It was now found that, as well as the waste gases making a roaring noise, a very shrill whistle could be heard over a large area of the neighbourhood; and we thought that the turbine shaft or gearing had been strained. It was inspected by ourselves and the makers, and found to be all right. Complaints were received from the neighbours and the discharge was taken off and a vertical cone fitted. This effected no improvement, so various types of baffles were experimented with on top of the cone. The most successful was of cylindrical shape fitted, as an extension to the cone, with baffle plates with holes drilled in them, and sheet asbestos fastened to the plates. This certainly stopped to some extent the whistle, and completely stopped the roaring.

Complaints still came in, so we slowed down the turbine to give us only 15/100 in. draught on the settings. This, of course, seriously affected the temperatures of the retorts, and the throughput was cut down from 4 tons to 3·4 tons per day. We next tried working with natural draught dampers half open, as well as the waste-heat boiler on, care being taken that the boiler draught did not exceed the natural draught. This was an improvement, but, of course, very inefficient. All settings were pointed well; still we could not exceed 25/100 in. The top four bars of the producers were bricked in, and the main secondary air uptakes were bricked up to 48 sq. in. instead of 225 sq. in., and each chamber was checked so that the producer gas and air were cut down to a minimum. The chimney was then closed, and with the turbine running at a fairly slow speed, 30/100 in. draught was obtained. The whistling noise, although not completely removed, is much reduced.

On bricking-up the firebars, we found there was a decided improvement in the amount of producer gas made by moving the water supply down from the top bar to the fifth bar—that is, the last bricked-up bar. Also the water used was cut down to about half. A great saving in fuel was also obtained reducing the quantity used from 5 cwt. per ton of coal carbonized to 2·5 cwt.

I should like to express my appreciation of the help which the engineering staffs of Messrs. West's Gas Improvement Company and Messrs. Spencer Bonecourt rendered over a long period in tackling this noise problem and the earlier one of complaints about dust.

Beyond the above we have had no trouble at all in maintaining good even temperatures of the combustion chambers throughout the installation, and find that the method of air regulation is admirable. The retorts themselves have shown very little signs of spalling or roughness, care always being taken to keep the retorts at about working temperatures during scurfing. Some of the retorts nearest the producers have become thin immediately above the fireclay courses for a distance of two or three chambers up. These lengths of retort have been cut out and re-set by the bricklayer climbing through the worm and using scaffolding inside.

The boiler at Leamington is fitted on the stack platform level, and although there is nothing against this in working results it makes the working floor very hot in the summer owing to the boiler preventing cool air coming through the ventilating panels on that side.

The tubes of the boiler are blown out three times each day with steam by means of a soot blower. We used to clean the tubes about once every fortnight with a steel spiral on a length of wire rope, but, after trying the recommendation of Messrs. Spencer Bonecourt of putting wooden chippings into the inlet products box, we find that we can keep the tubes clean by using the wire rope only about once every two months, which saves a very unpleasant and tedious job.

Lip Bucket Conveyor.

The lip bucket conveyor and coal elevator have given us very little trouble, care always being taken to keep the chain and links well lubricated. We find the ratchet type of Brookhirst starter, together with their ammeter, a great help, owing to the fact that any part of the machinery working with undue friction is at once observed by an increase in amperage. The difficulty of our coaling arrangements throws a lot of work on to the lip bucket conveyor, as it is working something like twelve hours a day.

Two or three months ago, after the plant had been working for about two years, some of the split cotter pins holding the links of the chain together were found to be broken, allowing the links to come away from the axles and trunnion pins and causing the chain to jam in the vertical guides. All the cotter pins were then thoroughly examined and new ones fitted where necessary. The conveyor was tested for alignment, and it was found to be quite all right. The renewable cast-steel bushes between the axles and the rollers did not seem to be getting their proper amount of lubrication. This oiling is done by means of an " Empire " type lubricator with four pumps, each supplying one side of the rollers. The pipes from these pumps were found to have moved, and in one case to have become unsoldered. The oil, instead of dripping on to the bushes, was dropping on to the links, and coal and coke dust had stuck to these, which prevented the bushes getting any oil at all. We have brushes made of short pieces of wire rope fastened vertically to the conveyor framework on the top track, so that the ends just rub the links, to prevent them getting too dirty; but these had practically worn away. The wire rope brushes were renewed and the " Empire " lubricator was repaired, the oil supply pipes from this being fastened securely to a board.

The chain still roamed badly from side to side of the track. Bushes were examined here and there, and were found to have worn very badly. We ordered sufficient bushes for the whole of the conveyor, and put a six-bucket length of new chain in, taking a six-bucket length of the existing chain out. This was taken apart and the rollers and links were thoroughly cleaned and the bushes renewed. The next six-bucket length was taken out and replaced by the re-bushed length. This was treated similarly. We did this till the whole chain was re-bushed, doing about 24 to 30 buckets each week. The time taken to remove one length and replace it with another was about one hour. We found the best way of cleaning the links and rollers was by burning-off the grease, &c., in a blacksmith's forge. The grease nipple in each roller was taken out and the grease chamber cleaned out and refilled. In the past the lubrication of the chain depended solely on the " Empire " lubricator, but now from time to time each roller is oiled with a gun.

Discussion.

Mr. F. J. Bengough (Birmingham), in proposing a vote of thanks to the author, asked for information as to the water content in the coke, in view of the free use of water in connection with the extractor gear mechanism.

The resolution was seconded by Mr. L. B. Chapman (Tipton), who congratulated Mr. Broadbridge on the work he had done for the removal of dust from the Glover-West settings. He understood that in Manchester an experimental plant had been installed by which water was sprayed inside the coke chamber, but he did not know whether it was successful. As to scurfing, he had always placed importance on the necessity of reducing the temperature of the retort to check disintegration of the brickwork.

The President (Mr. W. Macnaughton) complimented the author upon the way in which he had overcome difficulties at Leamington. He (the speaker) was a believer in maintaining good, even temperatures, and he asked for information as to the temperature maintained in the waste-heat boilers. He was surprised that, after two years' working, it should have been necessary to renew the cotter pins of the conveyor plant. This seemed to be a very short life, because, on a plant with which he was familiar, renewals had not become necessary after six years' working.

Mr. A. W. Elliott (Shrewsbury) said he was much interested in the method adopted for overcoming the dust nuisance, but he imagined that the moisture content in the coke was raised to a rather high figure. If the waste-heat boiler was driven by a steam turbine, he would like to know if the steam was discharged into the atmosphere.

Mr. A. R. Myhill (Birmingham) said he had paid a good deal of attention to the effect of using different grades of coal, and he had been impressed by the lack of uniformity that existed in coals even from the same district.

Mr. Broadbridge, in acknowledging the vote of thanks, stated that at Leamington they had not received complaints as to excessive moisture in the coke. As to the Manchester experiment of spraying water inside the coke chamber, he understood that it had not been altogether successful; at Leamington they found it more convenient to do the sprinkling from the outside. Regarding scurfing, he pointed out that they had no industrial load at Leamington, and it would be inconvenient to let down the temperatures. Their policy was to keep the temperatures fairly level. The free use of water probably explained the mischief to the nuts and pins on the conveyor, but very little inconvenience was experienced in carrying out the necessary repairs. The fan was driven by a turbine, and the steam discharged into the atmosphere. At Leamington they had not made any experiments in the use of different types of coal.

Yorkshire Junior Gas Association

The Working of a Fittings Department

By courtesy of the Halifax Gas Committee and the Engineer and Manager (Mr. W. B. McLusky), members of the Yorkshire Junior Gas Association met at the Halifax Corporation Gas-Works on April 18, to hear and discuss a paper by Mr. A. Wylie, of Sheffield, and afterwards to visit the Halifax Works. Between the two sessions of the day's programme the visitors were entertained at tea by the Halifax Gas Department. Mr. J. W. HORWILL (Bradford), the President of the Association, presided.

The visitors were welcomed by Alderman J. H. Waddington, Chairman of the Halifax Gas Committee, who remarked that they in Halifax were always glad to receive a visit from the Yorkshire Juniors.

Alderman Waddington was supported in his welcome by Alderman Rufus Stirk, J.P., O.B.E., former Chairman of the Gas Committee; and by Mr. W. B. McLusky, Engineer and Manager. At a later stage the meeting was visited by the Mayor of Halifax (Alderman John Carter).

The PRESIDENT, in responding to the welcome, said the Yorkshire Juniors were no strangers to Halifax. They had been welcomed there many times, and every time there was something fresh to see and as hearty a reception. They all knew that Mr. McLusky was one of the greatest friends the Juniors of the Gas Industry had. They knew also that in many respects he was a pioneer among gas engineers. Halifax had one of the most enterprising gas undertakings in the country, and they were all glad to know that its enterprise was amply justified by results, as illustrated by the fact that last year—despite the continued trade depression and curtailment of industrial load—the Halifax Gas Department had had the highest output it had ever attained. They all hoped the progress which the Department made year by year would be continued.

THE FITTING DEPARTMENT.

By A. WYLIE, Sales and Fittings Superintendent to the Sheffield Gas Company.

The fitting department of a gas undertaking forms an essential link between sales and service, and unless this section is organized and functions correctly, a great amount of endeavour may be wasted.

Primarily, this department is responsible for the fixing of all appliances. The duties, however, usually include such important items as Complaint Work; District Maintenance; Meter Installations, &c.

To my mind gasfitting as a trade has in the past suffered from what is termed in these modern times "the inferiority complex;" and this is indeed a matter for regret. Apart from gas undertakings, this section of craftsmanship is treated as a sideline only, and is designated by many as a dying trade. This state of affairs is unfortunate, for the practical side of gasfitting requires skilful treatment in execution, and the good judgment of the operative has often to be exercised to an even greater degree than in some trades at present enjoying pride of place.

The importance of the work entrusted to a gasfitter cannot be over-estimated. Provided he is supplied with the proper tools and has enthusiasm for the work entrusted to him, he can be just as effective in giving satisfaction and emphasizing the meaning of "service" as any other branch of our Industry.

Three essentials are necessary in this connection:

(1) The proper type of man.
(2) The correct tools for the job.
(3) The right appliance.

The most valuable advertisement an undertaking can procure is a satisfied customer. It is to the credit of our Industry to record many instances where good workmanship has brought repeat orders.

The personal appearance of the employee and his manner of address create a lasting impression. Incidentally, it is very necessary to discriminate, so that the right man is sent to the right job. From your experience, I trust you will agree that an A1 man soon becomes discouraged if continually sent to C3 jobs, or the fitter who can "slog in" on the carcassing of a new building is not always successful in a lady's boudoir.

IMPORTANCE OF THE FITTER.

Without the combination referred to, our endeavour to give service is wasted and unproductive. So that one may illustrate the important part a gasfitter plays in the lives of the community, it should be noted that the efforts of all propaganda work referring to the utility of gas are directly associated towards getting the gasfitter into the homes of the people.

Apart from the excellent support given to our Industry by the Technical Press, who are not slow in offering constructive criticism when required, the B.C.G.A. and most gas undertakings throughout the country spend thousands of pounds every year for the purpose referred to. An even greater expenditure is made by the appliance and fittings manufacturers and all the commercial departments within the Gas Industry; and the allied trades employ hundreds of highly technical and specially trained salesmen solely for seeking new business for the fitter to execute.

The gasfitter is the fighting unit for close-quarter encounters. Without the splendid contribution made by the gasfitters of to-day, our struggle for supremacy in the lighting, heating, and cooking fields would become more difficult than it is.

At the same time I should like to pay tribute to the various training centres in our country, where the gasfitter is encouraged to attend classes and obtain technical, theoretical, and practical knowledge of his trade. The products of these educational establishments are a credit to the Industry, and every possible encouragement should be given by undertakings to the young men in their employment to attend these classes. The confidence which comes from knowledge acquired by personal effort is the foundation of the "superiority complex."

ORGANIZATION OF A FITTING DEPARTMENT.

In the time at my disposal I will only refer briefly to the organization of a fitting department. The essential links towards efficiency may be briefly described as follows:

(1) To systematize the transactions so that they can be traced from receipt to completion.
(2) To choose the right type of man to supervise district work and to guide the men under his control.
(3) To supply appliances and all fittings on application, and have them transported with all necessary materials to the district, in readiness for fixing.
(4) To carry out the fixing work expeditiously and institute a system of inspection during progress of work and after completion.

During the year 1930, almost 365,000 ft. of piping has been used by gasfitters employed by the Sheffield Gas Company in the execution of fitting work, renewals, and repairs. Roughly speaking, this quantity of piping could extend 69 miles. Treated on an average basis, it is equivalent to a mile of piping per man per annum. When one considers this point in addition to the other duties, it is excellent proof that progress is being maintained in our area, and that we are giving satisfactory service.

This statement also proves the important functioning of gasfitters' work on the district, and the effect on the consumer when these duties are carried out in a pleasing and businesslike manner.

SERVICE PIPES.

To ensure successful gasfitting it is necessary to install piping of adequate size and to make provision for possible extensions. Inadequacy in sizes of pipes is the cause of many complaints; and until this error of ignorance is rectified it is impossible to give correct and steady pressure at any given point.

To avoid such trouble occurring in cases outside our jurisdiction, we inaugurated some time ago an arrangement with builders and architects whereby a payment is made by our Company on all pipes installed by private firms in accordance with a specification containing the undernoted conditions:

All piping to be of the best quality, the smallest size of pipe used to be ½-in. inside diameter.
Each fire point to be run of not less than ½-in. pipe, and no two fire points to be taken from less than ¾-in. pipe.
No gas fire point to be situated more than 1 ft. from the outside edge of the mantelpiece, and not more than 6 in. above the floor.
Cooker supply is to be of not less than ¾-in. pipe, and to be run direct from the meter to such a position that it will not need more than 3 ft. of pipe to connect the cooker up.
The Gas Company is to be notified by the sending in of this form as soon as the piping is completed and before the walls of the house are plastered or the floors inside laid, so that the Gas Company may ascertain whether the work has been sufficiently and properly carried out, and whether the same will stand a test equal to 4 lbs. air pressure. The test is for the Gas Company's satisfaction only, and notwithstanding the above test and payment, the builder shall be entirely responsible for the work and condition of the pipes, which will be his sole property.

Subject to the above test, and all points being properly plugged, the Gas Company will pay the sum of 3s. 6d. per point run.

During the last three years almost 1200 claims for installations on new properties have been applied for by private traders and passed for payment. This scheme can be recommended as a means of encouraging the private builder to use gas more extensively, and with the confidence that the potential consumer will have no complaint regarding unsightly pipes or inadequate supply.

During 1930 our Fitting Department completed the installation of the undernoted sold appliances:

Cooking appliances fixed	2583
Heating and hot water appliances fixed	2088
Fitting sales (miscellaneous)	7845
Average number of jobs completed per man per week	18
Average number of obs completed per man per day.	3

During 1930, the sale of appliances and fittings (exclusive of fixing charges) amounted to the sum of £25,390 12s. 6d.; and in order to show the keenness of the outdoor staff of the Fitting Department in seeking and obtaining new business I append complete allocation of money values as follows:

	£	s.	d.	£	s.	d.		
Combined showrooms				20,333	4	1	= 80 p.ct.	
Outdoor salesmen—								
Total sales	2,993	5	2					
Amount passed through showrooms	675	2	0					
				2,318	3	2	= 9·2	,,
Temporary outdoor salesman				577	13	2	= 2·2	,,
District inspectors				2,161	12	1	= 8·6	,,

The fitting sales work during 1930 also included the supplying and fixing of: 1362 oven squares; 4587 pendants; 8661 brackets; and 14,535 burners.

The gas oven square is very popular in our area, and can be adapted to any coal-fired range with success. The square is made of ¼ in. wrought iron shaped to the exact size of the oven and fitted with 3-hole iron jets placed 3 in. apart all round. These burners are fitted so that the luminous flame burns towards the centre of the oven. Special precautions are taken when fixing this type of fitting, so as to dispose of the products of combustion and prevent any chance of the flame smothering.

The method we have applied dispenses with the necessity of damaging the range by altering the flue arrangements or boring through metal parts, and consists of fixing a special sheet-metal attachment on the outer edge of the door and supplying a false sneck. When the door is shut, a top and bottom aperture is then provided and is capable of ensuring correct ventilation. Upwards of 7500 of these are in actual use within our area at the present time.

Building construction has reached a high state of efficiency, and provision is made to ensure stability and safety; yet ventilation is relegated as being comparatively unimportant. Where properly ventilated gas appliances are used there can be no stagnation of atmosphere; and they can be guaranteed to act when other methods fail. This is frequently lost sight of by modern builders and architects, who, buoyed up with the idea that electric radiators are the final word in heating, design buildings without chimneys or vents. Their failure is twofold, for they can neither ventilate nor heat the apartments satisfactorily.

Hot Water Supply.

An important outlet for gas is the generation of hot water.

Before fixing a gas geyser, special note should be taken of the size of the existing service pipe and meter, to ensure that the required quantity of gas is obtainable. A geyser constructed to supply 1½ gallons of water per minute requires not less than a ½-in. supply pipe, the 2-gallon to 2½-gallon size, ⅝-in. supply pipe, the 3-gallon ¾-in. supply pipe, and the 4-gallon 1-in. supply pipe—all inside diameter. These require a 10, 20, and 30 light meter respectively.

A geyser or similar apparatus should never be fixed on wood shelving, as this often becomes dry and cracks and has even been known to take fire. Enamelled brackets and shelves are usually provided, but where they are not procurable a wrought-iron shelf with rounded front and square back let into the wall approximately 3 in., and then cemented, will make a most satisfactory job.

Not less than ½-in. internal diameter water supply pipe should be used, together with a stop-tap to enable the flow to be reduced according to requirements. This last point is most essential, especially if the supply is taken from a high-pressure water main. Should the existing water supply be inadequate, a geyser fitted with a low-pressure automatic valve or water storage cistern is necessary. This prevents the interior of the appliance being damaged should other taps be turned on when the geyser is in use.

A flue is a most important part of fixing, and it should never be of smaller diameter than the flue connection on the apparatus. The geyser should always be fitted with a baffle, and the flue extended through the outer wall and constructed to discharge approximately 3 ft. above the roof eaves. This method is preferable to discharging the products into existing chimneys or under roofs, as occasionally the first-mentioned have a down-draught and while the burner would not be affected, due to the baffle being fixed, quantities of soot or fumes are liable to be discharged into the room where the apparatus is installed.

Condensation pipes should never be made to discharge into the bath or wash-bowl, as this causes a stain in enamelware. Such connections should be made on the inlet side of the trap of the waste water pipe.

Unfortunately the fixing of these appliances is not always entrusted to gas undertakings, but is often carried out by tradesmen lacking in experience. This causes consumers to be dissatisfied with the apparatus. We have only recently been called in to inspect three geysers fixed privately, one without a flue, the two others with flues discharging through the outside walls and left there with an open end. Any of these appliances might have been the cause of a serious accident, for down-draught was very pronounced, the flames in one case being blown out into the room, while in the other two cases it had been blown out altogether.

Instantaneous water heaters are not usually provided with a flue pipe connection, as they are only used intermittently. Where this type of apparatus is fitted in a small room, condensation on walls and ceilings will be pronounced. We overcame this difficulty by fixing a flue pipe in the usual manner, to discharge outside, complete with a copper conical hood made a little larger than the diameter of the apparatus, a condensation channel being fitted on the inside of the flue pipe.

Gas Circulators.

Prior to fixing a gas circulator, one should make certain that the existing installation is working satisfactorily. If it is not, one should locate the defect, for the fitting of the circulator will not remedy any defects already in the distribution pipes.

Should the circulator be required to do duty with the range boiler, do not connect the circulator to the existing circulation pipes, as these are usually only of sufficient size for the range boiler. It is more satisfactory to fit separate circulation pipes to the cylinder; and this can be done *in situ* with strong gun-metal ceiling plates bolted with brass bolts and nuts and soldered. This method has been used and tested by us for a number of years now, and, as well as being satisfactory, is a cheaper proposition than brazing.

Care should also be exercised in selecting the proper type of circulator suitable for local conditions. In Sheffield, due to the softness of the water supply, bower barffing and galvanizing will not prevent corrosion taking place, and even wrought-iron fittings such as nipples, &c., cannot be used, as we have found these on occasions to be absolutely solid with rust and the means of preventing proper circulation.

Great care should also be exercised in the fixing of flue pipes on circulators; and where possible the flue should be made to discharge outside. If there is a chimney where a coal fire is used, the flue may be made to discharge into it without fear, as the burning of the solid fuel will dry up all condensation. It is not to be recommended to use a chimney only for the products of combustion from a circulator, for the walls of the chimney will absorb the moisture and cause discoloration on the inside, besides doing damage to interior decorations.

The most useful temperature to obtain in a gas circulator is approximately 140°-150° Fahr., and this is most suitable for dish-washing purposes. Economy in gas consumption to the extent of 30-40 p.ct. could be obtained by lagging the pipes and cylinder; and this saving in fuel would soon repay the cost of the covering. It is surprising to find how few installations are treated in this manner.

Care should be exercised when installing gas pipes so that they are not in close proximity to electric conduits. Escapes of current are very insidious, and more common than we think. To avoid any chance of fusion, we have instituted a rule which states that on no occasion has gas piping to be installed unless there is a clearance of 5 in. from electric wiring or connection.

Discussion.

Mr. D. T. Livesey (Doncaster), opening the discussion, said he was particularly interested in the references to the effect of Sheffield's soft water on the internal fittings of water heating apparatus, and particularly in Mr. Wylie's statement that galvanizing and other usual preventive methods had proved ineffective. What steps did they take in Sheffield to prevent this incrustation inside pipes and apparatus? Wrought iron, they were given to understand, was no good. Would one be correct in assuming that the Sheffield difficulty was largely overcome by

using lead? If so, what effect had Sheffield water on lead pipes?

Mr. WYLIE said there was no doubt they were up against a great problem in Sheffield in the generation of hot water. They had to use lead up to the connections of the apparatus, which, of course, must be made of copper. Sometimes on the actual fittings they found gun-metal very good in resisting the effects of the water. Copper stood the effects of the water all right, but even that material tended to be affected after a certain number of years, and in certain cases they had had to get a stronger gauge of copper made.

Mr. H. E. WILDE (Bradford) said that in Bradford they had to deal with a similar difficulty owing to soft water, and they used copper pipes for hot water installations. He was particularly interested in Mr. Wylie's remarks on the desirability of selecting the right type of men for each type of job. Mr. Wylie mentioned that in Sheffield in the last three years they had had almost 1200 claims for installations on new properties by private traders. Was the payment of 3s. 6d. per point made whether a gas appliance was ultimately installed or not, and how many of these 1200 were eventually employed? Mr. Wilde was a little surprised that in his remarks regarding salesmen and district inspectors Mr. Wylie had not mentioned the sales which could be effected by the help of the meter inspectors. He (Mr. Wilde) thought the business to be obtained through meter inspectors was a matter which could be fostered much further. In Bradford they had got out details of the amount of business obtained last year by way of the meter inspectors, and the amount was extremely encouraging, although he had no doubt there was still ample room for extension. When they remembered that the meter inspector had the right of entry into every building where gas was used, there was no reason why he should not take into every building the service the undertaking could offer.

Mr. WYLIE, answering the question as to the 3s. 6d. payment in respect of points in new buildings, said this payment was not for lighting points, but was confined purely to cookers, wash-boilers, and fires. He was not in a position to give the actual percentage of the 1200 which were installed, but in the vast bulk of the applications there was a certain amount of success. They were nearly always assured of the wash-boiler and the cooker points, if not always of the fires. Mr. Wylie entirely agreed as to the importance of using the sales possibilities of the meter inspectors, and said that in Sheffield they encouraged this to the utmost.

DEALING WITH COMPLAINTS.

Mr. J. W. HOLROYD (Elland) stressed the value of Mr. Wylie's emphasis on close attention being paid to complaints. There was still, in too many cases, a tendency to treat complaints lightly, and send along any spare man who happened to be handy, instead of studying the nature of the complaint and sending somebody particularly qualified to deal with the trouble. It was from small complaints that large ones developed and did grave injury to business. He was glad Mr. Wylie had once again drawn attention to the vast amount of shoddy work done by private plumbers, under the pretence that it was gas-fitting. The signs on plumbers' shops to-day were nearly always "plumber, water engineer, and electrician." Rarely did they describe themselves as gasfitters, yet they continued to accept work in that direction and to do it badly. The training of the plumber to-day did not seem to include gasfitting. He (Mr. Holroyd) had a gasfitting class in the same technical school as a plumbers' class, and recently he was asked by the head of the college if he would provide a certain amount of gas-fitting work for the plumbing students to do. Never before, he understood, had they done any gasfitting work in their classes, and the plumbing trade seemed, indeed, to be side-stepping gasfitting entirely. Yet when it came to business, they would not leave it alone. They had to get fixed in their own minds that gas was best for lighting as well as for cooking and heating purposes. A good many of them tended to become slack in that regard. He had, for instance, talked to gasfitters, salesmen, and gas men generally who had electric lighting in their own homes. If they themselves did not uphold the use of gas by practical example, how could they expect other people to accept their declarations and do so?

Mr. WYLIE said he agreed entirely with Mr. Holroyd in the matter of gas men using gas themselves.

Mr. E. R. B. FRENCH (Leeds) remarked that he was much interested in Mr. Wylie's remarks as to the conversion of ovens. In Leeds, instead of putting a grid round the oven casting, they had put an internal lining throughout the oven. There was undoubtedly a wide field of business in conversion sets in this direction. Another wide field, especially in the poorer districts where people could not afford to re-equip themselves with gas appliances, was the conversion of the old coal-fired wash-boiler, or set-pot, as it was known in Yorkshire. He wondered if Sheffield had tapped that field very much. Within the past twelve months they in Leeds had carried out tests which proved that this could be made to give an excellent gas-washing service for people who could not afford to buy gas boilers. Such conversion served a double purpose in many houses of the poorer people where there was no bathroom, because the set-pot would be used both for clothes washing and bathing purposes, and there was therefore a double consumption. If, for instance, they considered Mr. Wylie's 7000 oven conversions and multiplied that by even a very small consumption per quarter, and multiplied again by four for the year, it was to be seen there was an astonishing figure for the year—a figure which could be added to substantially by set-pot conversions also. Mr. Wylie had made special mention of the subject of adequate ventilation. One would like to have his views in regard to the installation of flues to gas cookers. This was a point on which gas men seemed to have a diversity of opinion. In the installation of geysers Mr. Wylie had mentioned the fitting of a stop-cock for water, but made no mention of a stop-cock for gas. To his (Mr. French's) mind, this was a very important factor. In regard to circulator connections, Mr. French said he was not quite clear as to the type of connection Mr. Wylie was using. In Leeds they used a Colman connector. He would like to hear Mr. Wylie's experience with coke boilers. In regard to the difficulty of overcoming the effects of soft water on heaters, the extensive use of copper was expensive. Had Mr. Wylie experienced any difficulty with the internal flue of low-consumption heaters? The author's observations on sending the right fitter to a job were important, and especially so in regard to maintenance work. In some districts they made a point of a certain man for a certain class of job. In Leeds they always selected the best fitters for maintenance work, so that the man could tackle any job that might arise in a house. Mr. French said he would be interested to know, also, whether Mr. Wylie's undertaking gave any special terms to builders in the purchase of appliances. The amount of business obtained in Sheffield direct through the showrooms, as distinct from business through district inspectors, was, thought Mr. French, rather surprising. In Leeds they obtained a large amount of business from the district inspectors.

FOLLOWING UP HOT WATER INQUIRIES.

Mr. WYLIE, replying, said that if an inquiry in respect of hot water apparatus was made at the showrooms, it was followed up by the hot water inspector. The percentage of hot water orders taken direct at the showrooms was relatively small, and in the figures which he had given in the paper he included all sales of such appliances. To builders the Sheffield undertaking gave a special discount of 7½ p.ct. over and above the actual sale price. Mr. Wylie agreed as to the importance of training the best men for maintenance work, and in that respect the gasfitting classes of the Industry were very valuable. In the carcassing of houses they in Sheffield had to use a considerable amount of lead. The did install coke boilers on application, of the bower-barffed type, but they warned people that they could not guarantee the bower-barffing to last. Mr. Wylie agreed that a special stop-cock to regulate the flow of gas as well as one for the flow of water was very desirable. Makers of water heating appliances, he thought, were liable to send out apparatus with the jets passing rather too much gas, and it was often necessary to reduce this by changing the burners. In regard to set-pot conversion, he was not very keen on that idea, any more than he was on the idea of putting gas burners under solid fuel fish frying apparatus. They had done it in Sheffield when requested, but unless there were certain alterations made to the flue and setting, and particular care was paid to the actual flue itself, the thermal efficiency was low. Where it was possible, they in Sheffield preferred to recommend a complete replacement by a gas wash-boiler.

Mr. FRENCH said he could not agree. In Leeds they had installed something like 1200 to 1500 of such conversions, and found them very satisfactory. They diminished the ordinary flue outlet and put a high-power burner underneath. They found that in many cases set-pot flues were never swept, and when one installed a gas burner underneath such a set one was liable to get the old flue clearing itself with the heat and choking the gas flue. That was a possibility which had to be dealt with. In Leeds they put in a galvanized iron flue with a cowl. They did the conversion, with the necessary flue, for 17s. 6d., complete with 6 ft. of pipe. This kind of work, of course, was only done in cases of poorer class people, who would probably not be able to have gas firing at all otherwise. They were in houses rented from an owner, and the landlord's permission was obtained. One could well imagine that if one could get four or five thousand of these conversions in a district, and they were used twice per week—once for washing and once for baths—there was a very substantial consumption of gas in a year. In Leeds they were proving very satisfactory.

Mr. HOLROYD: The extent to which this set-pot conversion is done in Leeds rather makes one wonder whether they have been peculiarly unfortunate in that city in the sale of gas boilers. At Elland, proceeded Mr. Holroyd, they did nothing in that direction, but they sold gas boilers readily. They had 6000 consumers, and they had 4000 gas boilers on the district, so it would be seen there were not many set-pots left—converted or otherwise—in that area. One did, of course, find variations of this kind between one district and another. He had only once in his career converted an old set-pot to a gas set, and he thought if it was at all possible it was better to install a gas boiler.

Mr. F. FIRTH (Leeds): I think, after all, this is merely a question of getting such business as can be obtained, rather than get none. There are a good many cases where the people simply will not, or cannot, spend the money to have a real gas set, but will accept the cheaper conversion.

CONSUMERS SATISFIED.

Mr. A. B. HORSFIELD (Leeds) said he thought the fact that the whole of the complaints coming in from over 5000 conversion appliances could be dealt with by one man was fairly good evidence that the consumers using these sets were fairly well satisfied. The burner was on eight legs, which were adjustable, and the inner cone of the flame must be within half-an-inch of the set-pot bottom. In regard to oven conversions, he had found that, if one was not very careful, complaint of smothering was

possible. In Leeds they tapped the burner with a ⅜-in. tap, and put in a brass plug which they could screw right down—indeed, it could turn the gas off entirely.

Mr. WYLIE remarked that in Sheffield they also found they had the smothering trouble, and had to take special measures to overcome it. They fixed an injector which governed the supply of gas to the oven itself, and they tied down the makers of the oven to test the burners so that they passed only 3 c.ft. per jet.

Mr. V. J. J. SIDDONS (Barnsley) proposed a vote of thanks to Mr. Wylie.

Mr. C. H. CHESTER (Wakefield), seconding, said that the type of man in the fitting department was definitely improving, and he believed this improvement was due very largely to the Institution's Education Scheme. To-day they had in Yorkshire some 500 gasfitters receiving instruction under the Scheme, whereas, when the Scheme was started, there were not fifty. The point as to the type of man, temperamentally, for different classes of houses was a very important one. For the better-class house it was very desirable that the fitter should be able to talk to the housewife, and discuss matters in relation to appliances in a manner suitable to the class of customer. To his mind, the maintenance men were the men who should start inquiries which resulted eventually in orders. They were in a position to make useful suggestions to consumers, and they were in the best position to start a selling campaign. On the matter of ventilation, Mr. Chester thought that not enough was made of the valuable service which gas service itself gave in ventilating a room.

On the motion of Mr. RALPH HALKETT, jun. (Sheffield), seconded by Mr. FIRTH, hearty thanks were expressed to the Halifax Gas Committee and to Mr. McLusky for their hospitality.

Alderman WADDINGTON, replying, said he had been most interested in the paper and the discussion, and he had wondered whether there was not a very useful work which such an Association of the Gas Industry could do in persuading more undertakings to establish good maintenance systems. There were still undertakings which had no maintenance service. Though he was Chairman of a Gas Department which, he was confident, was one of the most efficient in the country—thanks to their Engineer and his staff—he had his own home in a district whose gas undertaking had no maintenance service. Some of the smaller undertakings were allowing the electrical people to walk in, because of the deficiencies in their gas service.

Mr. W. B. MCLUSKY said they in Halifax were always glad to welcome the Juniors, and the fact that the Mayor had come to the meeting, as well as the Chairman of the Gas Committee, showed how anxious they were to make Yorkshire gas men feel that they were at home in Halifax. The future of the Gas Industry depended on the Juniors; and anything he, as a Senior, could possibly do to help and encourage them would always be done gladly. So far as concerned any achievements of the Halifax Undertaking, he would emphasize that they were by no means the achievements of one man, but of an efficient and enthusiastic staff. A good manager was the man who managed to make other people work well and gladly. [Applause.]

The MAYOR OF HALIFAX (Alderman J. Carter), endorsing the response to the vote of thanks, said there was not much sign of dying about the Halifax Gas Undertaking, and he saw little sign of it in that meeting, representing the gas undertakings of Yorkshire. Gas had done a great service for well over a hundred years, and he was confident that it had many long years of important service still ahead of it.

Alderman RUFUS STIRK, J.P., O.B.E., said he had served as Chairman of the Halifax Gas Committee. He had also served as Deputy Chairman, and now he was serving as a member of the Gas Committee. To his mind there was no need for this constant reiteration of talk about electricity ousting gas. Each had its uses and its charms. Both had a wide field of service ahead.

Gas Lighting

By J. G. CLARK, of the Gas Light and Coke Company.

[Lecture before the London and Southern District Junior Gas Association on Friday last. A report of the discussion will be published in next week's "JOURNAL"]

When I first planned the notes for this evening's lecture I intended to include a large amount of numerical data regarding the lighting efficiency of modern gas units. Upon consideration, however, I concluded that the information at my disposal is not complete enough for this purpose, and it would seem desirable to reserve it for another lecture later on in the year. My remarks this evening may be regarded as introductory to a more detailed account which will come later.

I have noticed that in recent years the subject of lighting has not received much attention by the Junior Gas Associations, and this fact urges me to suggest that the Councils of the various Junior Associations might very well consider the desirability of including at least one paper on this subject every year. Although gas consumption due to lighting—even in this country where gas is still so largely used for illuminating purposes—is relatively small compared with gas used for other purposes, it is so important a "key" to further development of gas utilization that no effort should be spared to keep right up to date. If the Junior Gas Associations—and, for that matter, the Senior Gas Associations too—were to follow out the suggestion I have made, I feel sure the prestige of gas lighting would rapidly rise.

Fortunately, we have now—thanks to the Institution of Gas Engineers' Education Scheme—a large number of young people well versed in the technique of illuminating engineering, and the time is ripe for making our efforts in this branch of gas utilization much more scientific than hitherto.

In the remarks I have to make, I will endeavour to indicate some subjects that might very well form the basis for future papers; and I hope that some of the young people who have taken the Higher Grade Certificate in Gas Supply during the past two or three years will turn their thoughts in this direction.

AN OPPORTUNITY FOR REVIEW.

The year 1931 offers a suitable occasion for making a general review of gas lighting. In September next a large International Illumination Conference will be held in London, Glasgow, Edinburgh, and certain provincial cities. It is worthy of note that this great international movement is the direct outcome of the activities of the Gas Industry. It was at the Paris Exhibition in 1900 that the Gas Conference held in that year inaugurated what has since become the International Illumination Commission. In subsequent years meetings were held in Zurich, Berlin, and other places; and the activities of the Commission gradually enlarged. With the Conference held in America in 1928 the movement seems to have become firmly established, and it is likely that further co-ordination of all international activities in all branches of lighting (production, application, and measurement) will be made at the conference in Great Britain next September.

It should be a matter of pride to the Gas Industry that the farsightedness displayed by the gas representatives in Paris in 1900 has been completely justified. It seems well worthy of attention by the Junior Gas Associations. The fact that the Gas Industry has already done so much to develop the art of lighting should be sufficient to inspire any junior to spare no effort to maintain the prestige of modern gas lighting.

While speaking of historical matters, it is worthy of note that the art of photometry owes much to the Gas Industry. Quite a long list of names could be stated, each representing one in the Gas Industry who has added something to the art of photometry. Methven, Sugg, Letherby, Evans, Harcourt, Wright, and Simmance—to name a few who come into one's mind immediately—make a list of which the Gas Industry can be proud. The Harcourt ten-candle lamp still forms a reliable primary standard to which all secondary working standards may be referred.

While it is true that gas lighting is being challenged by our competitors, it is worthy of note that gas in this country is still the major means of providing artificial lighting; and competition is no new thing. I believe that serious and critical examination of the various methods of producing artificial light would show modern gas lighting to be of the very first order. Sir Leonard Hill has recently shown that the emission from incandescent mantles is particularly suitable to the human organism.

An interesting comment on this point came from the United States when Mr. Bernard J. Mullaney broadcasted a radio talk on June 28, 1930, in co-operation with the American Trade Association. He said "Edison's electric light, perfected in 1879, told gas lighting to move on. The Gas Industry countered with the Welsbach incandescent gas mantle, perfected in 1890. And right now, properly mantled gas lamps give more and better light for less money than electricity does—although popular favour rules otherwise." It would be interesting to speculate on the various influences that have enabled electricity to crowd out gas lighting in America.

REVIVAL OF GAS LIGHTING.

It must be gratifying to anyone interested in the Gas Industry to note the marked signs of revival in the matter of gas lighting in this country. The Technical Press of the

Gas Industry is to be congratulated on stressing the importance of this matter, and in urging that no efforts should be spared to maintain existing gas lighting and to see that gas has full attention in connection with new housing schemes. There are certain conditions that could be better met by some form of lighting other than gas, but the places where gas cannot be used with advantage are relatively few.

It seems to me that relative costs do not count quite so much as was current a generation ago. People are more inclined to study convenience and fashion nowadays. If this is true it would seem to suggest that other reasons than that of cost should be urged in favour of gas lighting. Although probably quite well known, the following points can be stated with advantage:

(*a*) Sir Leonard Hill has recently described the light emitted from an incandescent gas mantle as singularly suited to the human organism. Quite a lot of work has been done in recent years in studying the reaction of the nervous system to rays which are able to penetrate the skin. Sir Leonard Hill has come to the conclusion that the light from gas mantles from this point of view is of an high order.

(*b*) It is well known that gas lighting is accompanied by a certain amount of warmth. The radiant efficiency of an inverted incandescent burner measured thermally is about 30 p.ct., which means that it can contribute substantially to the comfort of the person using the light. In addition to this, the warm products of combustion distribute themselves over the ceiling, creating thereby what is virtually a large warm panel which radiates downwards. It might be urged by our competitors that this warming effect may sometimes be a drawback, which is in some measure true, as it is true of most useful things; but I think an examination of temperatures in this country over a whole year would show that 99 times out of 100 the warmth would be a distinct advantage, and the absence of it would call for some supplementary source of heat to maintain comfortable conditions.

(*c*) The diffusion arising from the relatively low intrinsic brilliancy of an incandescant mantle is an advantage whether diffusive glassware is used or not. The lower the intrinsic brilliancy the easier it is to bring about sufficient diffusion without using opal glass so dense that the loss by absorption is great. This low brilliancy also has some relation to glare—particularly in connection with street lighting—and is in favour of gas.

(*d*) Fog penetration by street lamps is by no means an unimportant factor—particularly in London. Although no information that might be called "scientific" is available in support of the advantage of incandescent gas lighting from this standpoint, any policeman will support this view. An attempt was made at Watson House last winter to examine this problem, but unforeseen difficulties turned up; and, as fog cannot be made to order, the work has still to be completed. It is doubtful whether any scientific investigation will do more than explain some of the factors that go to make up what might be called the policeman's point of view. It is possible to recognize some of these factors, as, for instance, the following: Diffusion, reflection, refraction, diffraction within the foggy medium. I think everything should be done to evaluate the significance of these various factors with a view to seeing in which direction gas lighting can be made even better; but the practical fact remains that people who use and control the roads during times of fog confirm the opinion that gas lighting is very high in order of merit.

(*e*) Great progress has been made in recent years in the control of gas lighting units. It is not necessary for me to enumerate these in detail. We have several variations of clock control in street lighting; also large groups of lamps, as, for instance, shops lamps, and lamps in lecture rooms, halls, and similar places, can be controlled from one point in any desired way. The "Newbridge" switch recently introduced for the control of domestic burners has proved very successful in practice. A special feature of it is that it permits of control—not merely by switching the light "on" and "off," but in dimming the light when this is required.

Reference to switches would hardly be complete without alluding to the fine work done in York in this connection. The strong lead given by Mr. Bloor is, I think, typical of what the Gas Industry needs in these days.

(*f*) The item of cost is put last because I do not believe it to be among the most important of the qualities of gas lighting. It is, of course, well-known to all gas people that gas lighting is the cheapest of all available illuminants, but if it did not possess the other properties alluded to above this item of low cost would be of very little value.

Looking back over the past twenty years, there are several aspects of artificial lighting of all kinds that are worthy of notice. It seems sometimes that the art of producing light has outrun the art of using it. It is the utilization aspect that requires attention at the present time. Artificial light is already a cheap commodity; indeed, considered in relation to the great extent to which society depends upon artificial lighting, it is probably one of the cheapest commodities known. Possibly, this is the reason why, generally speaking, it is still so badly applied. If it were ten times as expensive as it is now, methods of applying light for various purposes would probably have been developed in a more marked degree than has been the case.

A good many years ago I drew attention to the cheap and nasty gas burners and mantles that were being offered to the British public through ordinary retailers' shops. Since then, however, really good but cheap burners have been brought on to the market, and it is very uncommon nowadays to see displayed in shop windows burners that are so poor that they do more harm to gas lighting than anything else.

Accuracy in Burner Design.

In this connection, however, there are two or three points that are worthy of emphasis. The manufacturers of burners do not always realize the importance of accuracy. The injector orifices, for instance, should not be so large as to need the use of a regulator to adjust the consumption to the right amount. Gas regulators will no doubt soon be things of the past. Large numbers of burners are still made with reciprocating pins; these, however, are intended to serve not as regulators, but rather as an easy way of removing from the injector foreign matter that may interfere with the flow of gas. The orifices should be accurately drilled so that when the pin is drawn clear of the injector the amount of gas issuing at (say) 20 tenths pressure should be correct. Regulation of the flow of gas can then be effected by the tap.

A practical point that is worthy of attention is the trouble that may be caused by the injector being ragged owing to careless drilling. Experience has shown that this can be easily avoided. Nothing more than reasonable supervision at the works is necessary.

It is still a nice point whether the injector of incandescent burners should have only one orifice or several smaller ones. There is something to be said for both methods. It is sometimes assumed that a completely silent burner can only be produced by using a multi-orifice injector, but this is not entirely true. A burner that is practically silent can be made with a single orifice injector; and inasmuch as one large orifice is less liable to interference from dust than several smaller ones, it has advantages.

Governing in relation to gas lighting is worthy of careful consideration, especially in certain circumstances. In factories and workshops, for instance, when the difference between good and bad lighting might make a substantial difference in the throughput of the works, and therefore in the profits, governing can be considered with advantage. The same remark applies to church lighting, hall lighting, school lighting, and shop lighting, and in varying degrees to all branches of gas lighting.

Mantles.

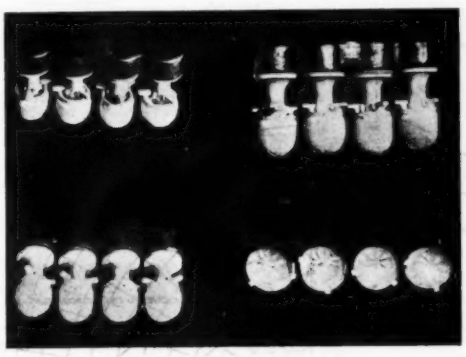
It is interesting to compare the technique of mantles over the past ten years or so. A striking development in gas lighting of recent years has been the widespread use of what is commonly called the cluster burner. As is well known, these are made in several sizes up to one containing 15 mantles of medium size. This system of producing light by gas includes some substantial advantages, as, for instance, the production of high candle-power units without any substantial increase in the intrinsic brilliancy of the source. The use of gas at the ordinary distribution pressures and the facility for grouping the mantles in a variety of ways has encouraged the extension of this method of using gas for lighting. There is, however, an important point that must be borne in mind if the best results are to be obtained. The fact that all the mantles receive energy from one bunsen burner involves accuracy in the shape and dimensions of the mantles much more so than is necessary in burners in which each mantle has its own regulator. Manufacturers should be encouraged to produce mantles ranging within only narrow limits in diameter and length, and it should be no hardship to them to be asked to supply their products to specifications including

limiting dimensions. A limit of 1 or 2 millimetres either side of certain standard dimensions is quite feasible, and is necessary if the whole of the mantles of a cluster lamp are to contribute their maximum amount of light.

The physics of cluster burners seems to be of extraordinary interest. There is first the pre-heating of the bunsen mixture before combustion and the heat interchange between mantles when close to each other. A simple experiment illustrating the latter point can be made by placing two incandescent mantles at different distances from each other.

TABLE I.

Distance Apart.	Horizontal C.P. of the Two Mantles.	
4½ in.	46·6	Increase in C.P. = 12½ p.ct.
3 ,,	47·0	
2 ,,	48·0	
1½ ,,	51·9	
1¼ ,,	52·5	



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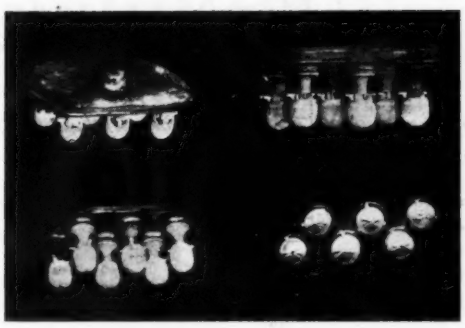

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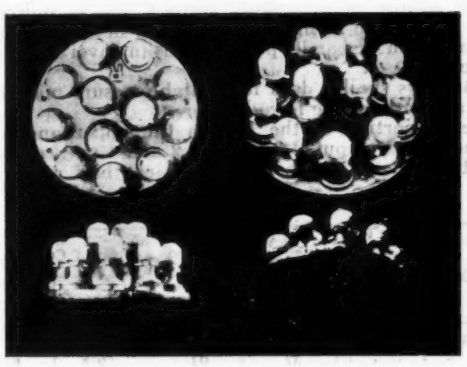

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Fig. 1.

Views of cluster burners taken vertically, horizontally, and at 45° above and below the horizontal.

There is a certain amount of interference between mantles especially when placed close together as in cluster lamps. Some aspects of this point are shown in fig. 1. I will leave this point now without further comment, as more information is necessary before the various arrangements of mantles can be compared. The transparency of mantles naturally arises, and needs close investigation.

In considering mantle developments over the past two decades, one is struck by the remarkable strength of the products now available. Opinion is still somewhat divided between the merits of mantles made from artificial silk and those made from ramie, but, considering all things, I favour the silk mantle. Practical experience with it in connection with both public lighting and private lighting confirms this. Silk mantles are not easily damaged by contact, as when a globe is carelessly taken from a burner; and when this is considered with the fact that, so long as it is intact the mantle will preserve its light-giving power for several thousand hours, immunity from mechanical damage is important.

It is not too well known that the depreciation of lighting power of a mantle is so small as to be negligible, provided the mantle is unbroken. A poor light from an unbroken mantle is due to a neglected burner, provided the gas supply is adequate.

Some Aspects of Artificial Lighting.

Artificial lighting may be divided into several broad classes—namely: (*a*) Domestic lighting; (*b*) industrial lighting; (*c*) street lighting; (*d*) commercial lighting; (*e*) scientific lighting; and (*f*) sports lighting.

The first three items will be readily recognized, but something may be said regarding the others. By commercial lighting I mean the lighting of shops and other places where public business is carried on. There has been a certain change of fashion in recent years which has led to the introduction of concealed lighting inside the windows. There still remains, however, a large body of opinion among business men that an abundance of light outside their shops is a great advantage in attracting customers, and there seems no reason why this should not continue to be a field which can be served by gas.

By scientific lighting, I mean a system whereby light is applied for medical treatment and other technical purposes. I have already alluded to the recent work of Sir Leonard Hill in which he gives the clinical value of gas lighting a high place.

From the technical point of view it is useful sometimes to have a source of light which approximates to daylight, and the advantage offered by special mantles which are impregnated so as to emit wave-lengths which are nearer to daylight than ordinary mantles have frequently been appreciated. There should be a field for mantles of this kind. It is, however, an interesting point how far these mantles should be used for domestic purposes. Personally, I do not favour their use. The human eye seems to welcome artificial light of slightly redder tint than what is called "daylight," although the reason for this may be hard to explain.

In regard to sports lighting, there are now several gas lighting installations which permit of games, such as tennis, being played. Gas lighting for this purpose has been applied particularly successfully in South London by the South Metropolitan Gas Company. It appears that from the points of view of colour, illumination, steadiness, and low cost, gas leaves little to be desired.

Street Lighting.

In view of the public importance of this aspect of lighting it is worthy of close consideration—especially in view of recent progress. The formation of a British Engineering Standards Association Committee to investigate the subject with a view to making a specification, together with the establishment of the Association of Public Lighting Engineers, has contributed enormously to the general interest, and it is imperative that all gas people should study present-day developments with great care. There is also the fine work done by the Illumination Committee of the D.S.I.R., under whose direction a Sub-Committee carried out investigations in Sheffield in 1928, and in Leicester last year. A specially favourable comment on gas lighting was made in the Sheffield report. Unfortunately gas was not included in the work done in Leicester.

It seems that we are passing through an important phase of development. Both progress and mistakes are being made, but we must all be prepared to learn from experience. The influence for good of BESA specifications in connection with standardization in industry generally—and British industry in particular—is well known. It is important to remember, however, that the influence of a strong specification upon the direction of development is of great importance. Bearing this in mind it is interesting to observe the manner in which the BESA Street Lighting Specification has influenced this aspect of artificial lighting. Stress is laid upon the importance of minimum illumination—that is, the illumination provided at certain specified test points. This has tended to encourage the use of high-power units arranged so that the strong rays that reach the distant points are not far removed from a hori-

zontal line drawn through the centre of the light source. These rays therefore tend to enter the eyes of the pedestrians or drivers using the road—a result that is in direct conflict with recommendations which have been made in connection with lighting in factories, workshops, schools, and similar places. It is true that the "test point" illumination value may be raised substantially in this way, but it is a great question whether the added glare does not more than neutralize this advantage. It is, I think, an opportune moment now to look at this matter fairly and squarely, in order to make sure that present-day development is on the right lines. Personally, I have great doubts, although, as is well known, it is being done in connection with gas lighting.

Glare, and Appearance of Lamps.

Directive reflectors can, I think, be applied with advantage, but to use them to direct a powerful but narrow beam of light to a selected "test point" seems to be going too far. Another point that is noticeable in modern street lighting is the attempt to screen lamps by opaque reflectors, so as to cut off the rays at angles sufficiently below the horizontal to prevent glare. A serious drawback with this is that, if the lamp is suspended so that it can swing in the wind, the angle of cut-off varies so that a flashing effect is produced at the midspan or "test point" which is in some respects worse than the steady glare produced by directive reflectors. Attempts have been made to lessen this effect by hanging from the edge of the reflector a curtain of diffusing glass. This seems a good idea, because, apart from lessening glare, it gives a better appearance to the lamp itself—alight or not. The appearance of a lamp in the street in the daytime as well as night is a matter of no little importance from the civic point of view.

Having in view recent practical experience it appears that a number of points in the BESA specification will need reconsideration. For instance, the allowable deterioration (50 p.ct.) seems too much. I should like to see at least 70 p.ct. as the minimum to which individual lamps should fall from the declared contract value. It hardly seems reasonable to allow an installation to depreciate from its rated class to the minimum of the next lower one.

Another interesting thing is that the illumination at the "test points" as defined by the BESA can be substantially higher than the minimum illumination discoverable by a survey of the working area of the road. This surely was never intended. The specification has encouraged the use of devices giving powerful, but quite narrow, beams of light. This seems to be poor "street lighting," but as it is permissible under the BESA specification great doubt must be thrown on the value of the recommendations as they stand now.

Appreciation is due to the BESA Committee for their endeavours to define and measure glare. It is an important and difficult subject, and the work done in Sheffield and Leicester is of importance. Gas lighting has, I think, nothing to fear from the standpoint of glare. The circumstances call, however, for as much constructive criticism as possible; and herein lies an opportunity for all gas people who wish to see gas continue as the premier street illuminant in this country.

Polar Curves.

It is many years ago now (1910) since I read a paper to this Association on the subject of radiation. In it was given a number of polar curves showing how light was distributed from units that were available in those days, and again in a later paper prepared jointly by Mr. Mackinney and myself and read before the Illuminating Engineering Society in 1913 some further information was given. Since these occasions many changes have taken place. New lamps and a new generation of men have come along, and it seems opportune to consider this matter afresh. Although the use of reflecting and shading devices has increased since those days the conditions are still disappointing and much remains still to be done, and it seems that the problem of using light in an economical and satisfactory way might very well be considered anew. I have no intention of doing this to-night, but hope that something I might say will encourage one of your members to come forward with some detailed data.

In introducing this aspect of gas lighting it occurred to me that it would be interesting to the members to have some geometrical considerations governing the distribution of light from incandescent gas mantles. The mantles in common use nowadays are made in a form which consists of a cylinder having a hemisphere at its base. The relation of cylindrical height to radius varies within limits shown in Table II. In fig. 2 are shown the distribution curves of the cylindrical and hemispherical portions separately, as determined by the formula which is stated. These two curves can be compounded so as to obtain a curve (which is shown) representing the distribution of light from the whole mantle. It is assumed, of course,

Table II.

Low Pressure.

Company's Designation.	Type.	Height h.	Radius r.	h/r.
A	Bijou	0·8 cms.	1·10 cms.	0·73
B	P.L. Bijou	1·2 ,,	1·10 ,,	1·09
C	Medium No. 2	1·0 ,,	1·40 ,,	0·71
D	Medium	1·5 ,,	1·5 ,,	1·00
E	Universal	1·8 ,,	1·8 ,,	1·00

High Pressure.

Type.	Height h.	Radius r.	h/r.
500 C.P.	3·25	0·43	7·5
1000 C.P.	3·75	0·56	6·7
1500 C.P.	4·5	0·75	6·0

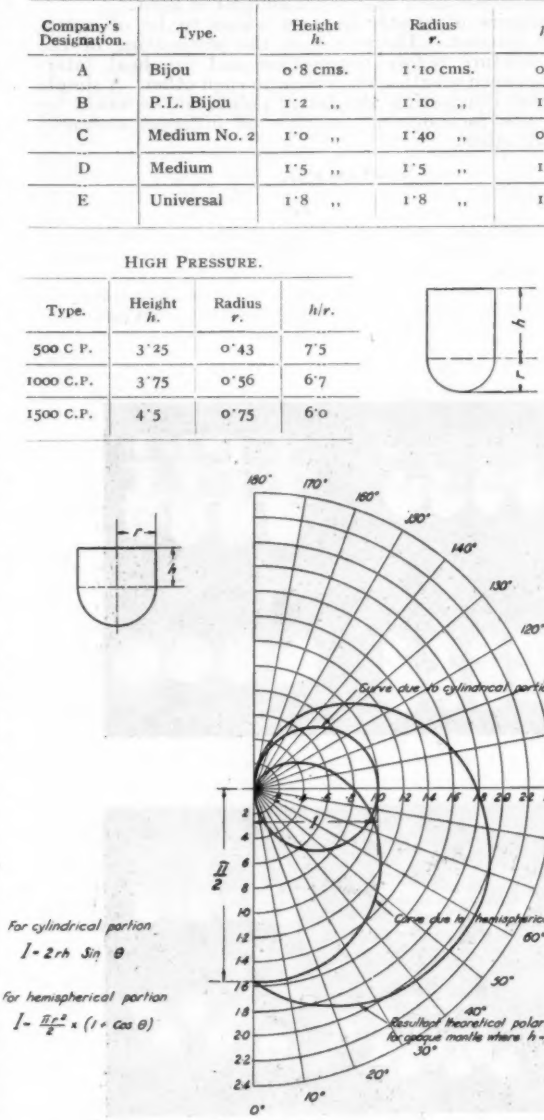

r
h
Curve due to cylindrical portion
Curve due to hemispherical cap
Resultant theoretical polar curve for opaque mantle where h = r
For cylindrical portion
I = 2rh Sin θ
for hemispherical portion
I = πr²/2 × (1 + Cos θ)

Fig. 2.

that the mantle is accurately formed and is uniformly bright. The curve in fig. 3 is an actual determination of the distribution of candle-power from an inverted mantle of the form $h = r$.

Fig. 4 shows similar data for a high-pressure mantle assuming a mantle of the form $h = 6r$.

If the proportion of the flux in the upper and lower hemispheres be computed from figs. 2 and 4 and compared with actual determinations, Table III. can be formed:

Table III.

Mantle.	Flux P.Ct. Calculated.		Flux P.Ct. Actual.	
	Upper Hemisphere.	Lower Hemisphere.	Upper Hemisphere.	Lower. Hemisphere.
Low-pressure mantle— $h = r$	37	63	36·8	63·2
High pressure mantle— $h = 6r$	46·2	53·8	39·4	60·6

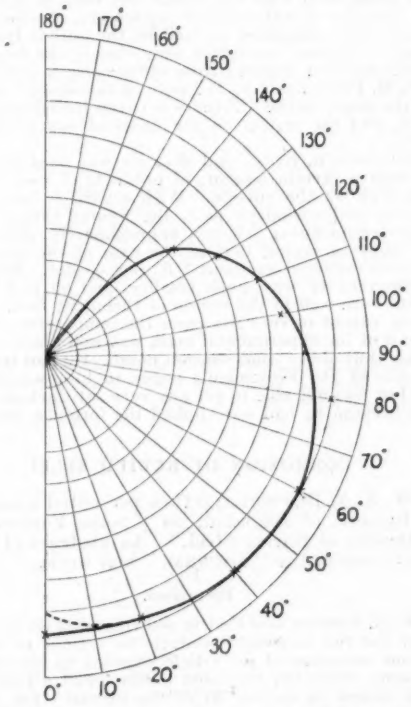
The similarity of the calculated and observed data for low-pressure mantles is quite useful to remember. The comparison for the high-pressure mantle (see Table III.) is not so good, due to interference in the upper hemisphere by a part of the lamp case, which transferred by reflection some light from above to below. The possibility of other forms of mantle may be studied in this way. For instance, a mantle shaped like a watch glass was shown recently by Mr. C. A. Masterman at a meeting of the Southern District

(London Area) Gas Salesmen's Circle. I will leave it to the gas supply students, some of whom I understand are present this evening, to calculate the probable form of the polar curve for the " watch glass " mantle. The same idea can be applied to other radiating bodies such as gas fires and combustor diaphragms.

Fires are now made with flat, concave, and convex fronts, all of which have different geometric properties.

The consideration of polar curves leads to the subject of the rating of lighting units. Any method employed should encourage development on right lines, and not allow freak appliances to take an unfair share of credit. I have no great faith in spherical values from a practical point of view, although scientifically they can be useful, especially for bare sources of light. Some data on this point are given in Table IV., from which it will be observed that the horizontal candle-power is by no means a true index of the total light emitted from bare mantles. Nothing short of polar curves can be completely satisfactory. With curves before him a person responsible for an installation can select a unit or units suitable for the job in hand. The magnitude and distribution of the candle-power is given by such curves.

There is a tendency to rate lamps by selecting from the polar curve the maximum value, and applying this figure



POLAR CURVE OF STANDARD GASLIGHT BURNER WITH SINGLE 'E' (UNIVERSAL) MANTLE

Fig. 3.

to the lamp. Providing the complete polar curve is given as well this practice of stating the maximum value is permissible and possibly advantageous. It might well be that the value of this maximum is an important feature of the lamp.

Useful Basis of Comparison.

Sometimes the efficiency of lamps is stated in terms of B.Th.U. per candle-hour, based upon the lower hemispherical values. This is a useful method of comparing gas lamps with each other, although some care is necessary. For instance, a lamp with a diffusing bowl may require more B.Th.U. per candle-hour than one fitted with a directive reflector, but it may be preferable on other grounds. An efficiency equal to 25 B.Th.U. per hour per hemispherical candle can be obtained with ordinary inverted units.

The lower hemispherical value of a complete lighting unit has the advantage of being directly applicable to the design of direct lighting installations. Let me give an example: A low-pressure single mantle unit consuming (say) 5 c.ft. per hour (500 B.Th.U. gas) has an efficiency of 25 B.Th.U. per hemispherical candle hour. This would yield in the lower hemisphere

$$4\tfrac{1}{2} \times \frac{500}{25} \times 2\pi = 570 \text{ lumens.}$$

With this information, together with the polar curve, the

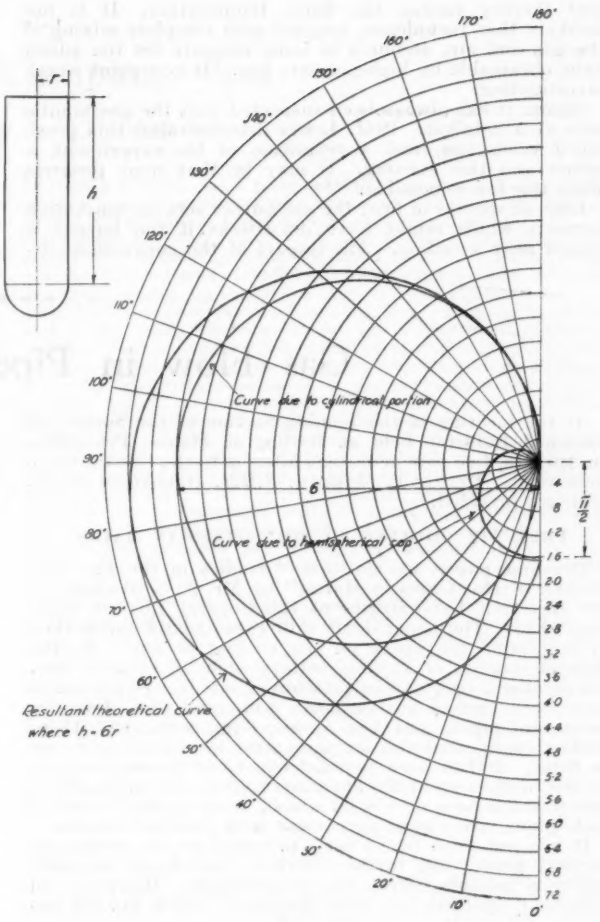


Fig. 4.

number and disposition of the units to give a certain illumination over a given area can be computed.

The following table is interesting. It shows the factor by which the horizontal candle power of units may be multiplied to give the M.S.C.P.

TABLE IV.

Description of Lighting Unit.			Maximum Horizontal Candle Power.	M.S.C.P.	Ratio Mean Spherical / Horizontal
No. of Mantles.	Size of Mantles.	h/r Ratio of Mantles.			
3	A	0·73	112	97·5	0·87
1	A	0·73	28·8	25·7	0·89
1	B	1·09	30·7	27·7	0·90
1	C	0·71	35·8	33·2	0·92
1	E	1·00	82	69·3	0·86
2	C	0·71	100	76·4	0·76
(every 20° in horizontal plane)					
5	C	0·71	161	154	0·96

The ratios in the last column represent the factors by which the horizontal candle power must be multiplied to obtain the mean spherical value.

In carrying out some tests in schools some years ago, computations were made based upon the lumens found on the " desk plane " divided by the hourly rate of gas consumption for all the lamps in the room. The ratio giving lumens per c.ft. per hour did not vary between wide limits (between 100 and 120) although the diversity of the illumination did. The diversity is a question of height and spacing.

Future Developments.

It is always interesting to speculate on the probable changes that are likely as time goes on. In the matter of efficiency we ought always to keep in mind the 12th power connecting the luminous emission from a mantle with the temperature. It means that an increase of 1 p.ct. in the temperature of the mantle will increase the yield of light by about 12 p.ct. Having regard to the mechanism of combustion of gases, one is also tempted to think of the possible effect of turbulence in accelerating the combustion

and thereby raising the flame temperature. It is not unlikely that turbulence, coupled with complete mixing of the gas and air, accounts in some measure for the added light obtainable by high-pressure gas. It is a point worth investigating.

Again, it has always been suspected that the gas mantle acts as a catalyst. Prof. Lewes demonstrated this possibility years ago, and a repetition of his experiment is before you this evening. It may be that some progress along this line is possible.

Like all sources of heat the gas burner sets up convection currents which might have drawbacks if the burner is placed near a ceiling. The impact of the convection currents is evidenced by the darkening of the ceiling. This point is worthy of investigation. It is well known that the dark stain is due to dust suspended in the air. If, therefore, the amount of air passing through the burner is reduced to a minimum the darkening effect upon the ceiling might be lessened. One can imagine a lighting burner designed to emit its hot products of combustion at the bottom of the globe or shade somewhat like a bottom flue outlet cooker. I am making this suggestion in the hope that inventors will get busy.

A device designed by the staff at Watson House permits of rapid tests being made on this point. It is before you this evening.

Gas Flow in Pipes, and Corrosion

At the meeting of the London Section of the Society of Chemical Industry held at Burlington House, Piccadilly, on April 13, two papers of some interest to the Gas Industry were read. Dr. G. T. MORGAN, F.R.S. (Chairman of the Section), presided.

FREE AIR COOLING OF HOT GASES IN MAINS.

The first paper was entitled "Studies in the Free Air Cooling of Hot Gases in Mains," by Mr. J. S. Walters, of the Research Laboratories of the General Electric Company, Ltd. The paper dealt with experiments undertaken to determine the effect on the cooling of gases flowing through mains, of various factors such as rate of flow, temperature, size, and orientation of mains. Experiments have been carried out on 3-in., 4-in., and 6-in. diameter horizontal pipes, and 3-in., 4-in., 6-in., 9-in., and 11-in. vertical pipes, and also on pipes with concentric tubes set in them. It has been found fairly easy to correlate the results in the case of the horizontal pipes, and an empirical equation has been developed which, when applied to large-scale plant, gives good agreement with observed results.

It has not been found easy to correlate the results on vertical pipes, and further work is considered desirable before a reliable correlation is obtained. However, an empirical equation has been developed which fits the experimental results reasonably well.

These equations are, for horizontal pipes:

$$L = \frac{30H}{W^{0.5}\ T^{1.15}\ D^{0.144}}$$

and for vertical pipes (down flow):

$$L = \frac{104H}{W^{0.75}\ T^{1.15}\ D^{-0.08}}$$

where L is the length, in feet, of pipe of diameter D, required to effect a loss of H. B.Th.U. per hour from a quantity W lbs. of gas per hour flowing through at a mean temperature T.

When the gas flows upward in a vertical pipe, a rather smaller heat loss is obtained for similar conditions of flow temperature, &c., than is obtained with down-flowing gas.

Discussion.

The CHAIRMAN asked the author whether the gases upon which the experiments were carried out varied at all in their chemical composition. Was illuminating gas used, and in what respect, if any, was there variation?

Mr. W. J. A. BUTTERFIELD said he gathered that the gases used in these experiments were identical in specific gravity, &c., but he would like to know to what extent these factors were transferable to other gases such as coal gas and hydrogen.

Dr. A. PARKER suggested that the possibility, in the change-over from stream-line to turbulent flow, of an increase of the velocity of the gases going through the tube might make a difference to the constants derived in the fundamental equation. In the work of Reynolds and Stanton, which was summarized and applied to the problems of the Gas Industry in a valuable paper read by Mr. Stephen Lacey before the Institution of Gas Engineers a few years ago, it was shown that the velocity of a gas through a pipe changed suddenly as the nature of the flow changed from stream-line to turbulent. When there was a sudden change like that, would there not be a sudden change in the sweeping action of the gas on the inner surface of the pipe? If there was that sudden change in sweeping action, then one would expect a sudden change in the constants in the equation brought forward by the author. If there was a change in velocity from stream-line to turbulent flow, the velocity at which it occurred varied considerably according to the diameter of the pipe, and that might account for the necessity to change the constants according to the diameter of the pipe. Another point was the viscosity of the gas; and also, in considering the problem of flow of gases through pipes, the hydraulic mean depth was taken into account. If tackled on the same lines as the flow of gases through pipes, it might be possible to bring the whole problem down to an equation more universally applicable to different gases.

Mr. H. HOLLINGS suggested that the value of the paper to the Gas Industry would be very much increased if it contained a more detailed reference to a comparison with other work being done in connection with the design not only of air-cooled condensers but also of water-cooled condensers. So far as he could remember, the expressions derived by the author from the work he himself had done resembled very closely the formulæ which Dr. Fishenden had deduced from other early investigations.

Mr. F. M. POTTER said he had noticed the absence of any reference in the paper to the difference between turbulent and stream-line flow, and the results on the gases of any condensation of moisture.

Mr. WALTERS, in reply, said that air was used in the experiments, with a certain amount of products of coal gas combustion—10 p.ct. at the outside. With regard to the question of stream-line and turbulent flow, the figures ranged from 0 to 30 ft. per second linear velocity, approximately, and he believed he was right in saying that in the case of the 3-in. pipe, the change-over occurred at about 1 ft. per second. For the larger pipes, the velocity was much smaller, and 90 p.ct. of the experiments were well in the region of turbulent flow. As to condensation, except in very few cases the temperature of the gases at the exit of the experimental main was well above 100° C., and they were thus above condensation point. He had tried to apply the results in Dr. Fishenden's paper to his own experimental figures, but was not able to get any very satisfactory agreement, perhaps because he had not applied the formulæ correctly.

CORROSION OF BURIED STEEL.

Mr. W. J. A. BUTTERFIELD then presented a paper by Mr. F. L. Bassett, of Baghdad, on "Some Factors Affecting the Corrosion of Buried Steel." An abstract of this paper was published in the "JOURNAL" last week.

Discussion.

Dr. W. H. VERNON said that in soil corrosion there was a great tendency for the corrosion products to remain *in situ*, as distinct from corrosion of an article exposed to air or immersed in solutions, when the corrosion product had a tendency to be removed almost as quickly as it was formed. For that reason there was a risk of the author's method of measuring corrosion in terms of corrosion per unit area being a little misleading, because they were dealing here with local penetration. The author appeared to have had some difficulty in removing the corrosion product, largely on account of its penetration into the interior; but quinoline could be used with great advantage in removing rust from iron. An important factor in corrosion in the field, which was likely to be missed in small-scale experiments, was the biological influences. Bacteria, in certain cases, affected corrosion in the soil, and even worms had a pronounced effect which was not likely to occur in experiments such as the author had carried out.

Dr. A. PARKER suggested the possibility that nitrogenous compounds in the soils might act as efficient carriers of oxygen, and so assist corrosion. In ordinary biological filtration and oxidation of organic matter, the presence of a proportion of nitrogen increased the rate of oxidation of organic matter, and it was quite likely it would increase the oxidation and corrosion of steel. In the case of the author's experiments, they had not been told whether the soil was fertile or not; but there seemed to be some necessity to consider the determination of nitrates, ammonia, and nitrogenous compounds likely to be present.

Dr. G. W. ANDERSON remarked that, while cast-iron mains were rapidly giving way to steel mains for many purposes, there was still considerable uncertainty as to the life of steel mains, and the Ministry of Health would only allow the Gas Industry to borrow money for them if the cost was written off in 12 years, whereas 50 years was allowed for cast-iron mains. It was a revelation to hear from the author that highly saline soils caused the least corrosion, because the gas companies in London were faced with a very serious problem in the corrosion of their gas-holders. They were using water which contained some 30 p.ct. of sea water—*i.e.*, 1 p.ct. of sodium chloride—and because of the differential action of the water inside and outside the holder, the metal was very seriously attacked.

Bombay Gas Company, Ltd.

An Increase in the Dividend

The Ordinary General Meeting of the Company was held at the London Offices, Moorgate Station Chambers, E.C., on Wednesday, April 22—Mr. WILLIAM GRAHAM BRADSHAW, C.B.E. (the Chairman), presiding.

The SECRETARY (Mr. A. Dickson) read the notice convening the meeting and the report of the Auditors; and the Directors' report and the statement of accounts for the year ended Dec. 31 were taken as read.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN, on rising to move the adoption of the report and accounts, said: With your permission, I will preface my usual comments on the accounts of the Company for the year 1930 with an expression of regret at the resignation, owing to ill-health, of Mr. Spencer Gore Browne from the office of Auditor. Mr. Gore Browne was first appointed in 1906, and has thus held office uninterruptedly for the long period of twenty-five years. His wide experience and knowledge of accountancy enabled him to render valuable service to the Company. The Directors regret the severance of the cordial relations which have existed throughout this extended tenure of office by Mr. Gore Browne, and desire to place on record their sympathy, and that of the shareholders, at his enforced retirement. As stated in the report, the Directors have appointed Mr. Frederick John Bradfield to the vacancy. Later on you will be asked to express your approval by his re-appointment to the office. Mr. Bradfield is the General Manager and Secretary of the Commercial Gas Company, and was previously their Accountant. He is also an Auditor of the Oriental Gas Company, which carries on its business in Calcutta, and he has therefore a large experience of a Gas Company's accounts both at home and abroad. I know nobody better qualified to deal with such accounts than Mr. Bradfield, and I have no doubt that you will show your agreement with the recommendation of the Directors when the time comes for his re-appointment.

A PERIOD FULL OF DIFFICULTIES.

During the year 1930 India passed through a period full of difficulties, accentuated by the world-wide depression in trade and the uncertainty of the Indian political situation. Bombay in particular has been far more adversely affected than any other important city in India, owing to it being the centre of the operations of Mr. Gandhi and the Congress Party's movements. Boycotting and Civil Disobedience have been practised so persistently that trading has been almost impossible. It had been hoped that as a result of the Round Table Conference business would improve, but such unfortunately is not yet the case. The effect of the prevailing state of unrest is reflected in the figures of India's trading during the year. The total imports of merchandise amounted to £138½ millions, showing a falling off of about £48 millions compared with 1929; while exports at £193 millions indicate a fall of £54 millions. Imports of gold and silver were £21 millions, being about equal in value to the imports of specie during the previous year. The visible balance of trade in favour of India dropped from £88½ millions to £34 millions. There was a considerable decline in trade between India and the United Kingdom, amounting to £25 millions in imports and over £9 millions in exports.

It is satisfactory to be able to report that, in spite of the depressed state of trade in Bombay, the Company's progress has not been seriously retarded. The set-back to manufacturers and traders generally, and the necessity for the exercise of strict economy on the part of the Company's consumers, has resulted in a slight reduction in the quantity of gas sold, the total of which was 469,406,000 c.ft., being a decrease of 9,268,000 c.ft., or 1·9 p.ct. It was only a few years ago that our General Manager in Bombay, Mr. W. T. Lane, was prophesying a steady 7 to 10 p.ct. increase per annum in the business of the Company, and he was fully justified at that time in his optimistic outlook upon the future; but the great political upheaval, combined with the world-wide trade depression which has since occurred, and which it was impossible to foresee, and the consequent sudden and serious change in the conditions of the City which has recently taken place, has forced upon the management a keen struggle to obtain the results submitted to you to-day. There was an increase of 2,661,000 c.ft. in the sale of gas for heating purposes, or 1·1 p.ct., but gas consumed in public lighting showed a reduction of 4½ million c.ft., or 2·1 p.ct. This reduction is partly due to the adoption by the Bombay Municipality of a policy of economy and retrenchment in all their departments, necessitated by a deficit in their revenues. There has also been a further decrease of over 6 million c.ft. for private lighting.

CAPITAL EXPENDITURE REDUCED.

The total capital expenditure, which stands at £391,719, is less by £2314 than at the end of the previous year, resulting from a credit of that amount in the account of meters. The ordinary expenditure for new mains, meters, and stoves, including other additions and improvements on the works, has been provided out of revenue. The capital per million c.ft. of gas sold is £834. This is quite a satisfactory figure for a Company operating abroad, but I trust that the Company's business will show a large expansion when political and trade conditions improve, and when this figure will automatically diminish.

Progress has been made with the work of improving our distribution system by the enlargement and relaying of existing mains. Another mile of additional mains has been laid, bringing the total mileage up to 209. A large number of mains and services have also been examined and repaired, where the construction of new roads has been carried out by the Bombay Municipality. It is agreed, I think, on all sides that excellent service is given by the Company in the supply of gas for public lighting, and that for the type of lamps in use the highest efficiency is being obtained. I understand that the Municipal Authorities are well satisfied with the work of the Company.

The Fittings Department was fully employed during the year, and there were issued to consumers a total of 1384 pieces of heating apparatus, including cooking stoves, geysers, hotplates, and boiling rings. The Company for some time past has carried out a policy of rendering gratuitous service to consumers in the matter of supplying labour free of cost for inspecting installations and advising and instructing consumers as to the economical use of gas apparatus. This involves some increase in our fittings and stoves expenditure, but it is advisable that the policy should be continued, as frequently the class of consumer the Company is called upon to deal with has little knowledge of the matter. The upkeep of the works has been fully maintained, and repairs and renewals have been carried out where found necessary. A new coke cutting and grading plant has been installed. This will enable the opening up of a market for graded coke, which we anticipate will command a better price than the imported country coke with which we have to compete. In the retort house, a trial setting of English silica segmental retorts has been installed, and a further setting of similar retorts of entirely Indian manufacture is in course of manufacture.

THE REVENUE ACCOUNT.

Turning to the revenue account, private gas receipts are less by £1782, owing to the decrease in the sale of gas for lighting purposes. The revenue from public lamps, after deducting cost of maintenance, is less by £538; but the revenue from meters, stoves, and fittings is more by £248. The income from the sale of residual products was less by £105. Coke and breeze produced less by £742, the quantity sold being 687 tons less than in 1929. The average price realized was 25s. 10d. per ton, against 25s. 7·3d. The coke market was in a depressed condition throughout the year, and there has been keen competition with imported coke from Bengal and other provinces at dumped rates. Owing to the poor state of the market, 1405 tons of coke were used in the water gas plant, with the result that at the close of the year the stock of coke was reduced to 123 tons, compared with 132 tons in 1929. The receipts from the sale of tar are more by £637, due to an increased sale of 59,548 gallons; the price per gallon being 4·9d., compared with 5·3d. in 1929. The demand for tar on the whole was better, but fell off towards the end of the year.

In total the Receipts are less by £2180, but this decrease is more than offset by the decrease on the other side of the revenue account in the total Expenditure, which is less by £2767—an increase in profit of £587. Coal, together with the cost of coke used in the water gas plant (£1967), cost £467 less than in 1929. The quantity of coal carbonized was 454 tons more. The cost of coal carbonized was 27s. 4d. per ton, a saving of 5·9d. per ton compared with the previous year. This saving, however, was not due to cheaper coal, for the average contract rate was slightly higher, but because we had the benefit of a full year's reduction of 1s. 10d. per ton in the rate of coal freight, which for the first six months of 1929 was at the higher rate. The quantity of coal carbonized was 29,505 tons, and the sale of gas per ton of coal carbonized amounted to 14,313 c.ft., compared with 14,466 c.ft. in 1929. The results from the retort house working are good, and would have been better but for the manufacture of some 54 million c.ft. of blue water gas, which needs to be enriched by the straight coal gas. The net cost of coal, after deducting receipts from residuals, was 9·4d. per 1000 c.ft., being the same as in 1929.

Repairs and maintenance of works and plant are less by £2318, but the expenditure under this head was high in 1929. It was quite sufficient in the year under review. Distribution charges show a net reduction of £240; repair and renewal of mains and services being less by £2337, and repair and renewal of meters and stoves more by £1584. We have now written down all obsolete meters, and we have nothing more to do in this respect than to maintain the customary rate of depreciation. Rents, rates, and taxes are more by £292, resulting from an increase in Indian income-tax. In management charges there is a net increase of £293, which is mainly due to additional costs of advertising gas in Bombay.

NET REVENUE.

In the net result of the year's work the balance of profit carried to the net revenue account is £24,028, which is more

than the profit of the previous year by £587. There is a profit on exchange of £5488, which is £43 less than in 1929, owing to slightly lower rates. The average rate of exchange of the rupee was 1s. 5·86d., against 1s. 5·9d. in 1929. Adding this exchange profit, and deducting the debit balance of interest, £1189, there is a net profit of £28,327 for the year. The interest is less by £398, because during the year we were gradually reducing our loan from the Bank to vanishing point. The undivided profit brought forward from the previous year (£36,993) brings the total available profit up to £65,320. Deducting from this the interim dividend of 3½ p.ct., amounting to £10,500, paid in November last, and the additions of interest to the reserve funds, which together amount to £2054, there remains £52,766, out of which a final dividend of 4½ p.ct. is recommended, making 8 p.ct. for the year. The final dividend, which is ½ p.ct. more than for the previous year, amounts to £13,500, and leaves £39,266 to be carried forward to the current year. This sum represents rather more than 1½ years' dividend at the current rate, and is £2273 more than was brought in from the previous year. These results are, I think, an achievement which, taking into consideration the adverse trade conditions to which I have alluded, reflect great credit upon Mr. Lane and his staff, and I have no doubt that the shareholders will appreciate them. I ought to add the caution that the future maintenance of such excellent results must depend upon the course of events in India with regard to the political situation and the general trade conditions.

With reference to the small increase in the dividend, I would point out that it is just sufficient to restore the rate which was paid for eleven years from 1917 to 1927 inclusive, and has cost the Company only £1500 over last year's dividend. That the dividend is strictly moderate in amount is shown by the quotation for the Company's shares in the Stock Exchange Official List, which is only 17s. to 18s. for the £1 share. That the rate of dividend is fully justified is evident from the large amount of work done on the district and to the plant during the last few years out of revenue. So far as can be seen, there is no heavy capital expenditure necessary in the near future. What we have to do now is to reduce the price of gas, and so attract a larger number of consumers. The extension of the Company's business is, however, hampered by a high-price contract for coal, which was forced upon us a few years ago when supplies in India temporarily fell short, and which will take two years to work out unless we can obtain some relief.

In the 1929 balance-sheet there were two items which have now disappeared—namely, Insurance Fund, £4751, and Workmen's Compensation Insurance, £2590—and in their place there now stands a Renewal and Contingency Fund (No. 6) of £7578. The Insurance Fund was built up of charges against revenue account to cover risk of loss of goods in transit to Bombay. The Workmen's Compensation Insurance Fund represented yearly charges of £500 against revenue account, to provide for claims by employees under the Indian Workmen's Compensation Act. The Insurance Companies in Bombay, having had a few years' experience of the risks incurred, have now been able to make an appreciable reduction in their rates of premium compared with the rates offered when the Act first came into operation. In these circumstances, the Board have considered it preferable that the legal liability of the Company should be covered by insurance, and negotiations have been concluded for effecting insurances covering the risks involved for an annual premium considerably less than the amounts previously set aside. Similarly arrangements have been made to cover by insurance any loss that may be incurred during the transit of goods by sea. These two funds, therefore, being no longer required for the purposes for which they were established, the sums standing to their credit, together £7341, have been placed to a Reneral and Contingency Fund, which will provide for expenditure on works of renewal or replacement other than the ordinary wear and tear borne by the yearly income and for meeting any other financial contingency. Another important feature in the balance-sheet is the disappearance of the item of "Temporary loan," the loan of £15,500 which stood in the balance-sheet of the previous year being now extinguished. The remaining items do not call for any special comment.

Loyal Service.

Mr. Lane, in his annual report, commends the excellent and loyal service which the staff and workmen have rendered the Company. He states that during the last twelve months there have been many occasions on which their loyalty had been tested severely, and that when it has been necessary to call on them to give of their very best they have responded readily and with the very best spirit. In this respect, Mr. Lane adds, the management have had a lighter load to carry than the prevailing conditions might have imposed upon them, and the good service of the workmen has enabled them to concentrate on other matters of importance. There is no doubt that in large measure the successful work of the past twelve months, and the Company's freedom from any serious falling off in its business, have been due to the policy which Mr. Lane and his colleagues in Bombay have persistently pursued, of strict non-interference and neutrality in politics and Local Government matters. The utmost consideration and goodwill have been extended to all communities and parties alike, and our staff have worked with and for the Congress Party in the same friendly spirit that has always been shown to others. As a Public Utility Company, it has been recognized that our duty is to maintain a strict impartiality, and to serve all our customers equally to the best of our ability. We have therefore maintained friendly relations with all, and we may justly look in return for equal trading rights with Indian firms whenever a new Constitution is established. It is, of course, of paramount importance that, in view of the possibility of far-reaching Constitutional changes being made in the Government of India in the near future, every influence that is possible should be exercised to ensure that British undertakings working for the development of trade should be properly safeguarded, and that every effort should be made to promote reciprocal preferential arrangements and the promotion of friendship between the two countries.

Looking Forward.

As regards the future, in the present state of trade depression and political uncertainty it is not wise, or indeed possible, to prophesy. In Bombay all the Public Departments and large trading firms are recording heavy deficits, and are curtailing programmes of work and economizing in every way possible. Mr. Lane gives a word of warning that until normal business is resumed it may be that we shall have to incur some shrinkage in our own business, but he assures us that no energy is being or will be spared by the staff and employees to further the Company's interests.

I must conclude my remarks by paying a well-deserved tribute to Mr. Lane and his British staff, and also to the Indian employees of the Company, for the excellent results of the year's work in the face of many and serious difficulties. That they have been able to surmount all obstacles is due to the skill and ability of the chief officers so well led by Mr. Lane, and to the indomitable pluck and perseverance displayed by all ranks, which is characteristic of the British race; but even these qualities would have been vain but for the loyalty and courage displayed by our Indian employees. To all classes of the Company's servants we owe a debt of gratitude and admiration which can hardly be overstated. I need not say that from Mr. Dickson and his staff at home we have received the same reliable and efficient service which they have always given to the Company.

I now beg to move:

> "That the report of the Directors and the statement of accounts for the year ended Dec. 31, 1930, now submitted, be, and the same are hereby, received and adopted."

The Deputy-Chairman (Mr. H. H. Macleod) seconded the resolution.

Captain W. J. Liberty asked whether the falling off in gas used for public lighting was due to a decrease in the number of lamps.

The Chairman replied that the authorities had reduced the hours of lighting. There were more burners, and about the same number of lamps.

The report and accounts were then unanimously adopted.

Dividend, Re-Elections, and Votes of Thanks.

On the proposition of the Chairman, seconded by Mr. Stanley H. Jones, M.Inst.C.E., it was agreed:

> "That a final dividend for the year ended Dec. 31, 1930, of 4½ p.ct. (*less* income-tax at the rate of 2s. 3d. in the pound) be now declared payable on and after May 1, 1931, making, with the interim dividend of 3½ p.ct., a dividend of 8 p.ct. for the year."

The retiring Directors (Mr. W. G. Bradshaw and Mr. S. H. Jones) were re-elected, on the motion of the Deputy-Chairman, seconded by Mr. A. M. Paddon, M.Inst.C.E.; and the Auditors (Messrs. Alfred Morland, F.C.A., and Mr. F. J. Bradfield) were re-appointed on the proposition of Mr. F. R. Smith, seconded by Mr. H. F. Hills.

Mr. Paddon proposed a hearty vote of thanks to the Secretary, the Engineer and Manager in Bombay, the staff, and employees, both in India and in London. He said the efforts of every one of them were sympathetically appreciated by the Directors. Those working in India had not only climatic conditions to contend with, but many other difficulties as well; and when all such obstacles were surmounted in the way they had been, full credit should be given.

Mr. Robert H. Glen, F.C.A., in seconding, said he had had the pleasure of visiting the Company's works not very long ago, and spent some little time in Bombay, during which period he received courtesy at the hands of Mr. Lane and the staff for which he felt very grateful. Of all the works he visited in the Far East, there was none better in organization than those of the Company, and certainly there was no town in the Far East or nearer home which was so well provided in its public lighting. But what had impressed him most of all was the excellent relations existing between the European staff, the Indian staff, and the community of Bombay. This was very heartening, and he agreed with the Chairman that the satisfactory character of the balance-sheet presented that day was largely due to this fact.

Captain Liberty said he would like to support the vote, as he had not long ago met the Company's Lighting Inspector in this country, and had found him absolutely up to date in every respect.

The vote having been heartily passed, the proceedings concluded with a similar compliment to the Chairman and Directors for the able manner in which they had conducted the operations of the Company during the past year.

Parliamentary Intelligence

[From Our Special Correspondents.]

House of Lords.

Private Bills.

The Guildford Gas and Cranleigh Electricity Bill and the Mid-Southern District Utility Bill, having passed the Commons, have been read a first time, and referred to the Examiners.

The Select Committee on the Royston and Brodsworth Gas Bill is meeting to-morrow, but the Bill is not likely to be taken then, as there are four other Bills in front of it.

Special Order.

A Special Order on the application of the Stroud Gaslight and Coke Company has been presented, and referred to the Special Orders Committee.

House of Commons.

Private Bills.

The Lowestoft Water and Gas Bill has been reported with amendments from the Unopposed Bills Committee.

The petition of the Southampton Gaslight and Coke Company against the Southampton Corporation Bill has been withdrawn. The Bill is now before Select Committee (Group E).

Price of Coal to Gas Companies.

Mr. ALBERY asked the Secretary for Mines approximately to what extent there had been a rise in the price of coal to gas companies during the last few months.

Mr. SHINWELL said he was not aware of the contract prices paid by gas companies for their coal.

Mr. ALBERY asked if he was aware that the price of gas had recently been put up, and if he would inquire whether it was due to the rise in the price of coal.

Mr. SHINWELL said that if there was any gas company aggrieved by any increase in the prices of coal, they could apply to the Committee of Investigation in their neighbourhood to have the matter dealt with.

Mr. ALBERY said it was the consumer who was aggrieved and not the gas company.

Mr. SHINWELL replied that similarly, if the consumer felt aggrieved at any increase in the price of gas which he believed to be due to the increased price of coal, he might take the matter to the Committee of Investigation.

Lowestoft Water and Gas Company's Bill.

The Unopposed Bills Committee of the House of Commons (over which the Rev. H. Dunnico, Deputy-Chairman of Committees, presides) considered this Bill on Wednesday, April 22, and it was ordered to be reported for third reading. It has already been dealt with by the House of Lords. (Its contents and its passage through the Unopposed Committee of the House of Lords were reported in the "JOURNAL" for Jan. 14, p. 105, and March 18, p. 782.)

As the result of a report by the Board of Trade during the early stages of the Bill's passage, the limitations imposed with regard to the amounts to be carried to reserve and contingencies funds have been more clearly defined. The percentages allowed to be carried to these funds in any year are to be percentages of the "issued" capital as distinct from the "authorized" capital.

Metropolitan Gas Companies' Testings.

The Gas Referees' report of the official testings for the past quarter gives the following average calorific values for the gas supplied by the Metropolitan Companies named.

Commercial Gas Company.—501·4 B.Th.U. (declared calorific value, 500 B.Th.U.).

Gas Light and Coke Company.—502·4 B.Th.U. (declared calorific value, 500 B.Th.U.).

South Metropolitan Gas Company.—562 B.Th.U. (declared calorific value, 560 B.Th.U.).

South Suburban Gas Company.—561·4 B.Th.U. (declared calorific value, 560 B.Th.U.).

Tottenham and District Gas Company.—501·3 B.Th.U. (declared calorific value, 500 B.Th.U.).

Wandsworth, Wimbledon, and Epsom District Gas Company.—472·2 B.Th.U. (declared calorific value, 470 B.Th.U.).

IDEAL HOME EXHIBITION

OLYMPIA. *Stand No. 140.*

A few days only are available for the inspection of the latest ideas in Automatic Gas-Heated Hot Water Supply Apparatus on Stand No. 140 (Ground Floor) Empire Hall.

A Potterton installation with "VICTOR" Automatic Thermal Storage apparatus yields an abundant supply of hot water with the greatest flexibility whenever the demand occurs, and at other times, both day and night, maintains the water HOT with a consumption of 1·7 cu. ft. gas per hour—less than 2d. per day.

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GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

As was anticipated, there was no increase in the volume of business on the Stock Exchange last week, and markets on the whole were dull and uninteresting. Some improvement, however, is anticipated after the Budget statement; but nothing in the nature of a return to really normal conditions can be looked for until a definite all-round advancement in trade is established.

Transactions in Gas stocks and shares were about normal, and prices in many instances showed fractional increases over the previous week. Several improvements in value were recorded, the lead being taken by Imperial Continental ordinary with a rise of 5 points to 360-380. The Company had recently announced a final dividend for the 12 months to March at the rate of 12½ p.ct., making 20 p.ct. for the year, against 17½ p.ct. This dividend will be paid on a larger amount of capital, as the Company issued to stockholders in May last £300,000 of new stock at £2 10s. per £1 on stock. Alliance and Dublin gained a further 2 points to 100-105, and, having regard to the settled state of affairs in Ireland, there would appear to be every justification for some further appreciation in the value of this security. The Company paid a dividend of 6⅔ p.ct. in 1926, 7 p.ct. in 1927, and for the past three years has distributed 7⅔ p.ct. per annum, so that the yield on the current price on the latter rate works out at £7 8s. 9d. p.ct. Bombay £1 shares were in demand, and, after rising 1s. during the week, *cum* div., eventually closed 6d. higher at 16s. 6d.—18s. 6d. *ex* div. Other ordinary stocks to improve were British, Sheffield (at Sheffield), and Wandsworth, each gaining 1 point. Wandsworth 5 p.ct. preference also strengthened 1 point.

The accounts of the Colombo Gas and Water Company, Ltd., for the twelve months to December show a balance of net revenue amounting to £25,301 (against £30,084). It is proposed to pay a dividend of 10 p.ct. per annum on the ordinary shares (free of income-tax) less 5 p.ct. interim dividend paid in October last, and 7 p.ct. per annum (less income-tax) on the 7 p.ct. preference shares less an interim distribution of 3½ p.ct. All these rates are the same as a year ago. To the general reserve £5000 has been added, against £10,000 for 1929. The balance to be carried forward is £14,497, against £14,279.

Particulars have been received from the Wandsworth, Wimbledon, and Epsom District Gas Company of a sale by tender of £60,000 3 p.ct. perpetual debenture stock at a minimum of £99 p.ct., and £250,000 5 p.ct. preference at a minimum of £97 p.ct., the yields at these rates being respectively £5 1s. and £5 3s. 1d. p.ct. The proceeds of the issue are required for repayment of bank loan, redemption of mortgage bonds, and to meet the cost of mains, appliances, &c., necessitated by the continual rapid growth of the Company's business and for general purposes.

Current Sales of Gas Products.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *April* 27.

The values of tar products are as follows:

Pitch, 45s. per ton f.o.b.

Creosote, for export, 5½d. per gallon f.o.b.

Pure toluole, 1s. 11d. to 2s. per gallon; pure benzole, 1s. 6d. to 1s. 7d. per gallon; 95/160 solvent naphtha, 1s. 4d. to 1s. 5d. per gallon; pyridine bases, 3s. 3d. to 3s. 6d. per gallon.

All prices of spirits are *ex* sellers' works.

Tar Products in the Provinces.

April 27.

The average prices of gas-works products during the week were: Gas-works tar, 17s. 6d. to 21s. 6d. Pitch—East Coast, 42s. 6d. to 43s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 42s. 6d. to 43s. f.o.b.* Toluole, naked, North, 1s. 6⅔d. to 1s. 7½d. Coal-tar crude naphtha, in bulk, North, 5½d. to 6d. Solvent naphtha, naked, North, 1s. 2d. to 1s. 2½d. Heavy naphtha, North, 11d. to 1s. Creosote, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 1½d.; Scotland, 3¼d. to 3½d. Heavy oils, in bulk, North, 5⅔d. to 5⅞d. Carbolic acid, 60's, 1s. 1d. to 1s. 2d. Naphthalene, £10 to £12. Salts, £3 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port, it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *April* 25.

Trading is confined, mainly, to refined tars for road purposes; but tar-acids show some improvement in throughput, although values remain weak.

Pitch.—Prices are nominal at 37s. 6d. to 40s. per ton f.o.b. Glasgow for export, and about 40s. per ton *ex* works for home trade.

Refined tar to Ministry of Transport Specification is in steady demand, with quotations round 2½d. to 2⅝d. per gallon f.o.r. in buyers' packages.

Creosote.— The better grades continue to find a regular outlet. B.E.S.A. Specification is 2⅜d. to 3d. per gallon; low gravity, 3⅛d. to 3¾d. per gallon; and neutral oil, 3d. to 3¼d. per gallon—all f.o.r. in bulk.

Cresylic.—The volume of business has increased slightly during the week. Pale, 97/99 p.ct., is 1s. 3d. to 1s. 4d. per gallon; dark, 97/99 p.ct., 1s. 2d. to 1s. 3d. per gallon; and pale, 99/100 p.ct., 1s. 5d. to 1s. 6d. per gallon—all *ex* works naked.

Crude naphtha.—Value remains steady at 4d. to 4½d. per gallon.

Solvent naphtha.—Quotations are unchanged, but orders are scarce. 90/160 is 1s. 2d. to 1s. 3d. per gallon; and 90/190, about 1s. per gallon.

Motor benzole.—Distillers are disinclined to offer until after "Budget day." Meantime value is 1s. 2d. to 1s. 3d. per gallon.

Pyridines are unchanged with 90/160 nominal at 3s. to 3s. 3d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole:

	s.	d.		s.	d.	
Crude benzole	0	5½	to	0	6½	per gallon at works
Motor "	1	0	"	1	1	" " "
Pure "	1	4	"	1	5	" " "

New Capital Issues.

Swindon United Gas Company.—Messrs. A. & W. Richards are offering for sale by tender £45,000 5½ p.ct. preference stock of this Company. The minimum price is £96 per £100, yielding £5 14s. 7d. p.ct. Tenders should arrive at Messrs. Richards, 37, Walbrook, E.C. 4, not later than 3 p.m. on Wednesday, May 6. An advertisement appears in the "JOURNAL" to-day.

Trade Notes.

Gledhill-Brook Time Recorders.

From Messrs. Gledhill-Brook Time Recorders, Ltd., we have received a new pamphlet describing a number of their recorders for office, shop, or warehouse use, and also an example of wage-paying racks.

Glover-West Plant at Newcastle.

The Newcastle and Gateshead Gas Company have placed a contract with West's Gas Improvement Company, Ltd., of Manchester, for the re-modelling of the carbonizing plant, of 2 million c.ft. per day capacity, at their Elswick Works.

Contracts Advertised To-Day.

Coal.

The Chertsey Gas Consumers' Company invite tenders for the supply of coal. [Advert. on p. 304.]

The Newbury Corporation invite tenders for the supply of gas coal. [Advert. on p. 304.]

Retorts.

The Dewsbury Gas Department invite tenders for the re-setting of two beds of horizontal retorts. [Advert. on p. 304.]

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Apl. 24.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 5	5	5	Aldershot 5 p.c. max. C. ...	77—82	...	...
522,992	,,	,,	4	4	Do. 4 p.c. Pref. ...	75—80	...	...
1,551,868	,,	Apl. 9	7⅞	7⅞	Alliance & Dublin Ord. ...	100—105	+2	102½
374,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb. ...	70—75	...	...
522,655	,,	Mar. 5	7	7	Barnet Ord. 7 p.c.	124—129	...	126—127
300,000	1	Apl. 23	1/4½	1/9⅝	Bombay, Ltd.	16/6—18/6*	+/6	18/—18/9
174,500	10	Mar. 5	9	9	Bournemouth 5 p.c. ...	15—16	...	...
500,050	10	,,	7	7	Do. B 7 p.c. ...	12½—13	...	...
439,160	10	,,	6	6	Do. Pref. 6 p.c. ...	11⅛—11⅜	...	...
50,000	Stk.	Dec. 18	3	3	Do. 3 p.c. Deb. ...	60—63	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	81—84	...	...
357,900	,,	Mar. 19	7½	7½	Brighton & Hove 6 p.c. Con.	112—117	...	...
371,880	,,	,,	6⅝	6⅝	Do. 5 p.c. Con.	102—105	...	...
1,287,500	,,	Feb. 19	5	5	Bristol 5 p.c. max.	94½—95½*a*	...	...
120,420	,,	Dec. 18	4	4	Do. 1st 4 p.c. Deb. ...	78—80*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	78—80*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	99½—100½*a*	...	...
855,000	,,	Apl. 9	7	8	British Ord.	110—115	+1	112—114½
100,000	,,	Dec. 18	7	7	Do. 7 p.c. Pref.	109—114	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	74—77	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	92—97	...	...
160,000	,,	Jan. 8	5	5	Cambridge 5 p.c. Deb. ...	95—98	...	...
100,000	10	Dec. 4	10	6	Cape Town, Ltd.	9½—10½	...	9⅞—9⅞
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	6½—7½	...	...
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb. ...	72—77	...	...
636,860	,,	Feb. 19	6	6	Cardiff Con. Ord.	96—99	...	...
237,860	,,	Jan. 8	7½	7½	Do. 7½ p.c. Red. Deb. ...	97—100	...	...
157,150	,,	Feb. 19	5	6½	Chester 5 p.c. Ord.	85—90*b*	...	...
98,936	1	Oct. 9	†2/-	†2/-	Colombo, Ltd. Ord.... ...	29/—34/-	...	...
24,500	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref.	18/—20/-	...	...
609,204	1	Apl. 9	1/4⅛	15'27*d*	Colonial Gas Assn. Ltd. Ord.	16/—18/-	...	...
296,053	1	,,	1/7½	17'67*d*	Do. 8 p.c. Pref.	17/6—19/6	...	...
2,073,280	Stk.	Feb. 19	6	6	Commercial Ord.	93—96	...	94½
475,000	,,	Dec. 18	3	3	Do. 3 p.c. Deb. ...	57—60	...	...
787,560	,,	Feb. 19	7	7	Croydon sliding scale ...	107—110	...	110—110½
453,100	,,	,,	5	5	Do. max. div.	82—85	...	84—85
542,270	,,	Mar. 5	7	10	Derby Con.	120—123*c*	...	...
55,000	,,	Dec. 18	4	4	Do. Deb.	65—70*c*	...	...
209,000	,,	Mar. 5	5	5	East Hull Ord. 5 p.c. ...	72—75	...	...
1,002,180	,,	Mar. 19	†4	†6½	European, Ltd.	92—97	...	93—94
18,953,033	,,	Feb. 19	5⅔	5⅔	Gas Light & Coke 4 p.c. Ord.	18/—19/-*f*	...	18/6—18/11½
2,600,000	,,	,,	3⅔	3⅔	Do. 3⅔ p.c. max.	63—66	...	...
4,294,691	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	78—81	...	79½—80⅔
5,694,095	,,	Dec. 18	3	3	Do. 3 p.c. Con. Deb. ...	60—63	...	61⅔—62⅔
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—103	...	102⅔—103¼
2,500,000	,,	—	—	—	Do. 4½ p.c. Red. Deb. ...	95—97	...	95½—97
161,480	,,	Mar. 5	10	10	Harrogate Cons. 10 p.c. max.	158—163	...	...
82,500	,,	Mar. 19	7	7	Hastings & St. L. 5 p.c. Conv.	98—103	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	82—85	...	...
70,000	10	Oct. 9	§	10	Hongkong & China, Ltd. ...	13—14	...	...
213,200	Stk.	Mar. 5	6	6	Hornsey Con. 3½ p.c. ...	91—94	...	...
2,436,594	,,	Nov. 6	25	15	Imperial Continental Cap.	360—380	+5	360—372
223,130	,,	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	78—83	...	...
235,242	,,	Mar. 5	8½	8½	Lea Bridge 5 p.c. Ord. ...	127—130	...	...
2,145,907	,,	Feb. 19	6	6	Liverpool 5 p.c. Ord. ...	98⅝—99⅝*b*	...	...
600,000	,,	Mar. 19	7	7	Do. 7 p.c. Red. Pref.	98½—100½*b*	...	...
165,736	,,	Feb. 19	9	9	Maidstone 5 p.c. Cap. ...	128—133	...	...
63,480	,,	Dec. 18	3	3	Do. 3 p.c. Deb. ...	54—57	...	...
75,000	5	Dec. 4	†10	†10	Malta & Mediterranean ...	6—6½	...	...
392,000	—	Apl. 2	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	86—89*	...	...
675,000	Stk.	Nov. 20	†8	†6	Montevideo, Ltd.	95—105	...	...
2,061,315	,,	Mar. 5	5	5⅔	Newcastle & Gateshead Con.	16/9—17/6*d**f*	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	74—75*d*	...	...
691,705	,,	Jan. 8	3½	3½	Do. 3½ p.c. Deb. ...	67½—68½*d*	...	...
277,285	,,	Nov. 5	5	5	Do. 5 p.c. Red. Deb.	98—100*d*	...	...
199,940	,,	Mar. 5	7½	7½	North Middlesex 6 p.c. Con.	115—120	...	...
396,160	,,	Feb. 5	5	5	Northampton 5 p.c. max. ...	74—79	...	...
300,000	,,	Apl. 23	9	7	Oriental, Ltd.	100—105*	−2½	...
60,000	5	13 May, '15	—	—	Ottoman	0—½	...	...
205,162	Stk.	Dec. 18	8	8	Plym'th & Stonehouse 5 p.c.	110—115	...	...
424,416	,,	Feb. 19	8	8	Portsm'th Con.Stk. 4 p.c.Std.	122—127	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	78—81	...	...
686,312	,,	Jan. 22	4	4	Primitiva 4 p.c. Rd. Db. 1911	84—87	...	...
389,813	,,	Dec. 18	4	4	Do. 4 p.c. Cons. Deb.	84—87	...	...
150,000	10	Apl. 9	6	6	San Paulo 6 p.c. Pref. ...	8—8½	...	...
1,736,968	Stk.	Mar. 19	6½	6½	Sheffield Cons.	103—105*c*	+½	...
95,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb.	79—81*c*	+1	...
90,000	10	June 5	†4	†5	South African	4—6	...	...
6,709,895	Stk.	Feb. 5	5	7½	South Met. Ord.	103—106	...	103¾—104½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	112—115	...	114—115
1,895,445	,,	Jan. 8	3	3	Do. 3 p.c. Deb. ...	60—63	...	...
734,000	,,	Mar. 5	6½	6½	Do. 6½ p.c. Red. Db.	98—100	...	...
1,000,000	,,	Jan. 22	—	4	Do. 5 p.c. Red. Deb.	100—103	...	...
91,500	,,	Mar. 5	8½	8½	South Shields Con.	107—109*d*	...	...
1,543,795	,,	Feb. 19	6½	6½	South Suburban Ord. 5 p.c.	102—105	...	103¾—104
668,837	,,	Dec. 18	5	5	Do. 5 p.c. Deb.	100—103	...	101½
647,740	,,	Feb. 19	5	5	Southampt'n Ord. 5 p.c. max.	77—80	...	78—79
121,275	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	75—78	...	...
179,014	,,	Mar. 5	8	8	Sutton Ord.	120—130	...	...
94,500	,,	Jan. 8	5	5	Do. 5 p.c. Deb.	96—99	...	...
250,000	,,	Mar. 5	7	7	Swansea 7 p.c. Red. Pref. ...	96—99	...	...
200,000	,,	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	100—103	...	...
1,076,490	,,	Mar. 5	6⅝	6⅝	Tottenham District Ord. ...	102—106	...	105—106
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	101—104	...	...
199,005	,,	Dec. 18	4	4	Do. 4 p.c. Deb. ...	77—80	...	79
85,701	,,	Mar. 19	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	74—79	...	...
310,694	,,	Mar. 5	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	102—107	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	88—93	...	89—89½
1,322,220	,,	Mar. 5	7	7	Wandsworth, Wimbledon, and Epsom Cons. ...	112—115	+1	112½—114½
426,000	,,	,,	5	5	Do. 5 p.c. Pref.	96—99	+1	...
1,013,464	,,	Dec. 18	5	5	Do. 5 p.c. Deb.	100—103	...	100½

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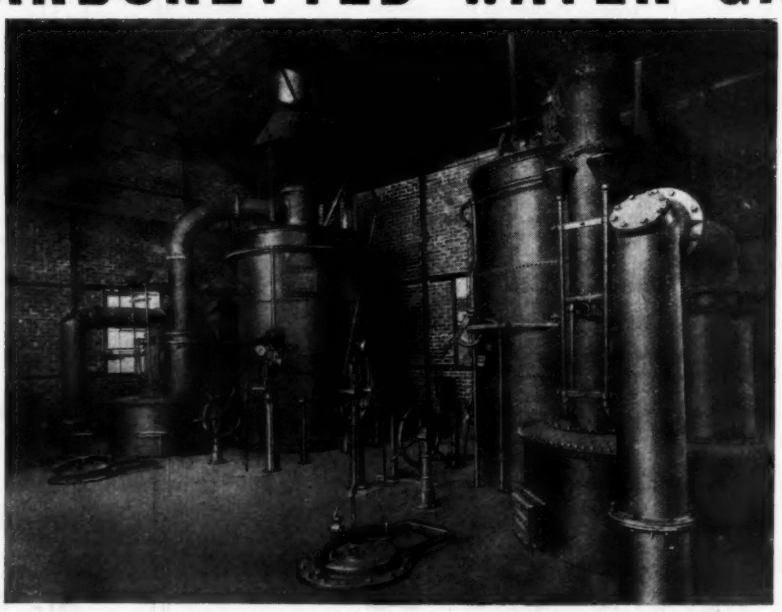

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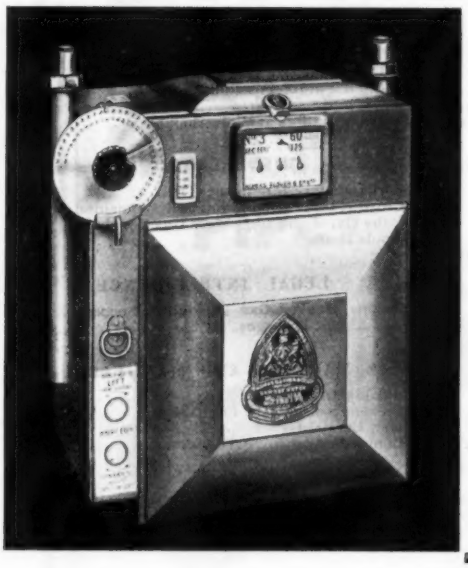

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